A COMPLETE LINE OF HIGH PRESSURE DUCTWORK

Spiral Manufacturing Co., Inc.

MANUFACTURERS OF COMMERCIAL AND INDUSTRIAL AIR CONDITIONING
AND PNEUMATIC CONVEYING DISTRIBUTION SYSTEMS

Standard Physical Properties of Spiral Pipe

Spiral Galvanized Pipe Weight Table
Lbs. per foot

Pipe Size	Nominal U.S. Standard Gauge					
	26	24	22	20	18	16
3”	0.8	1.1	1.3	1.5		
4”	1.1	1.4	1.7	2.0		
5”	1.4	1.7	2.1	2.5	3.4	
6”	1.6	2.0	2.5	3.0	3.9	4.8
7”	1.9	2.4	2.9	3.4	4.6	5.6
8”	2.1	2.8	3.3	3.9	5.2	6.4
9”	2.4	3.1	3.8	4.4	5.9	7.2
10”	2.6	3.4	4.2	4.9	6.5	8.0
11”	2.9	3.8	4.6	5.4	7.1	9.1
12”	3.2	4.1	5.0	5.9	7.8	9.6
13”	3.4	4.5	5.4	6.4	8.5	10.7
14”	3.7	4.8	5.8	6.9	9.1	11.2
15”		5.1	6.2	7.4	9.8	12.5
16”		5.5	6.6	7.8	10.4	12.8
17”		5.8	7.1	8.3	11.1	13.3
18”		6.1	7.5	8.8	11.7	14.4
20”		6.8	8.3	9.8	13.0	16.0
22”			9.1	10.8	14.3	15.6
24”			9.9	11.7	15.6	19.2
26”			10.8	12.7	16.9	20.8
28”			11.6	13.7	18.2	22.4
30”			12.4	14.6	19.5	24.0
32”			13.3	15.6	20.8	25.6
34”			14.1	16.6	22.0	27.9
36”			14.9	17.6	23.3	28.8
38”				18.5	24.6	29.8
40”				19.5	25.9	32.0
42”				20.5	27.2	33.5
44”				21.5	28.5	35.2
46”				22.5	29.8	36.7
48”				23.4	31.1	38.3
50”				24.5	32.4	40.0
52”				25.3	33.7	41.6
54”					35.0	43.2
56”					36.3	44.8
58”					37.6	46.4
60”					38.8	48.0
62”					41.1	50.7
64”					43.4	53.4
66”					44.7	55.1
68”					46.1	56.7
70”					47.4	58.4
72”					48.8	60.1

Nominal Thickness	Gauge	Lbs/Ft²
.0635	16	2.66
.0516	18	2.16
.0396	20	1.66
.0336	22	1.41
.0276	24	1.16
.0217	26	.91

Spiral standard pipe outlined in boxes.

A special note to our readers

Special made fittings
Special items are made on a time and material basis. Once accepted for production they cannot be cancelled, nor can they be returned for credit.

Check Measurments Carefully

Terms and Conditions
All shipments F.O.B. factory Mpls, MN
No returns unless authorized by: Spiral Manufacturing Co., Inc.

Request return authorization form #66A or download from web site.

This publication is designed to present accurate and authoritative information with regard to the subject matter covered. It is distributed with the understanding that neither Spiral Manufacturing Co., Inc. nor its members collectively or individually assume any responsibility for any inadvertent misinformation, omission, or for the results in the use of this publication.

Bursting Pressure (Seam Failure)

Pipe Size	24 Gauge		22 Gauge		20 Gauge		18 Gauge	
	PSI	“wg	PSI	“wg	PSI	“wg	PSI	“wg
3”	*	*	*	*	*	*	*	*
4”	500	13865	*	*	*	*	*	*
5”	380	10537	480	13310	*	*	*	*
6”	310	8596	360	9983	500	*	*	*
7”	230	6378	280	7764	400	11092	*	*
8”	200	5546	240	6655	312	8652	450	12479
9”	160	4437	180	4991	250	6933	350	9706
10”	147	4076	170	4714	225	6239	325	9012
11”	125	3466	150	4160	175	4853	280	7764
12”	112	3106	130	3605	165	4575	240	6655
13”	95	2634	120	3328	145	4021	225	6239
14”	85	2357	105	2912	135	3744	185	5130
15”	82	2274	90	2496	120	3328	170	4714
16”	78	2163	85	2357	112	3106	160	4437
17”	63	1747	81	2246	100	2773	145	4021
18”	56	1553	50	1387	82	2274	140	3882
20”	54	1497	64	1775	82	2274	120	3328
22”			52	1442	71	1969	100	2773
24”			48	1331	66	1830	90	2496
26”			42	1165	54	1497	82	2274
28”			37	1026	50	1387	70	1941
30”			33	915	45	1248	66	1830
32”			30	832	37	1026	58	1608
34”			28	776	37	1026	54	1497
36”			27	749	33	915	50	1387
38”					30	832	50	1387
40”					30	832	42	1165
42”					29	804	36	998
44”					29	804	36	998
46”					29	804	33	915
48”					29	804	33	915

Internal Negative Pressure to Collapse

Pipe Size	24 Gauge		22 Gauge		20 Gauge		18 Gauge	
	P.S.I.	“wg	P.S.I.	“wg	P.S.I.	“wg	P.S.I.	“wg
3”	**	**	**	**	**	**	**	**
4”	**	**	**	**	**	**	**	**
5”	**	**	**	**	**	**	**	**
6”	**	**	**	**	**	**	**	**
7”	**	**	**	**	**	**	**	**
8”	**	**	**	**	**	**	**	**
9”	11.0	304.7	**	**	**	**	**	**
10”	7.8	216.1	14.0	387.8	**	**	**	**
11”	5.5	152.4	8.6	238.2	**	**	**	**
12”	3.7	102.5	6.6	182.8	14.0	387.8	**	**
13”	2.5	69.3	4.9	135.7	7.8	216.1	**	**
14”	1.6	44.3	3.2	88.6	4.9	135.7	**	**
15”	1.6	44.3	2.2	60.9	4.2	116.3	14.0	387.8
16”	1.5	41.6	1.7	47.1	3.8	103.9	12.0	332.4
17”	1.3	36.0	1.6	44.3	2.8	77.6	7.9	218.8
18”	1.2	33.2	1.4	38.8	1.6	44.3	6.6	182.8
20”	1.2	33.2	1.3	34.6	1.6	44.3	4.5	124.7
22”	***	***	1.3	36.0	1.4	38.8	2.8	77.6
24”	***	***	1.2	33.2	1.3	36.0	2.5	69.3
26”	***	***	1.2	33.2	1.2	33.2	1.6	44.3
28”	***	***	***	***	***	***	1.4	38.8
30”	***	***	***	***	***	***	1.3	36.0
32”	***	***	***	***	***	***	1.2	33.2
34”	***	***	***	***	***	***	1.2	33.2
36”	***	***	***	***	***	***	***	***

* Theoretically did not fail at 500 PSI *** Less than 1.2 PSI
** Did not fail at -14.7 PSI (-407 “wg)

Spiral standard pipe outlined in boxes.

Spiral Manufacturing Co., Inc.
11419 Yellowpine Street N.W. • Minneapolis, MN 55448-3158
Phone: 763-755-7677 • 800-426-3643 • Fax: 763-755-6184

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Products

Installation & Special Components

Applications

Engineering Data

Spiral Pipe

Economy, Strength & Versatility

About Spiral Manufacturing Co., Inc.

Spiral Manufacturing Co., Inc. is a major North American manufacturer of lock-seam, high pressure Spiral pipe and fittings. We offer a complete line of standard commercial and Industrial Spiral pipe, fittings, and custom fabrications designed to meet all standard specifications. Our products are engineered and built to meet or exceed all SMACNA (Sheet Metal and Contractors National Association) standards, and you can expect quality and on-time delivery, whether you need a few components or a complete system for a major installation. For additional information, please visit our web site at **www.spiralmfg.com**.

Spiral Manufacturing Co., Inc. headquarters—Minneapolis., Mn

Advantages of Spiral Pipe

The advantages of high pressure Spiral pipe compared to traditional rectangular duct are numerous and compelling:

Attractive appearance—exposed Spiral duct is attractive and is frequently specified by architects because of its superior aesthetic appeal. Paintable Spiral duct can be finished to blend in with, or stand out from, the indoor environment.

Painted Spiral Duct used in a retail application

Economical to install—the unique attributes of Spiral duct can reduce installation costs:

- Easier to install through and around structural framing
- Longer spans reduces installation operations and the number of connections and hangers required
- Connections are made quickly and easily, and are easier to seal.

Lower cost of ownership—Spiral duct reduces upfront and operating costs:

- Low air leakage, optimal airflow characteristics, and less pressure drop allow smaller and more efficient air moving equipment
- Inherently stronger, allowing the use of lighter gauge, less costly metals
- Efficiently manufactured from strip steel to any diameter
- Spiral duct's smooth interior traps less dust and is easier to clean

Many options and accessories—a solution to almost any system design requirement:

- Manifold ducts efficiently handle complex distribution requirements and reduce installation time and cost
- Standard components for every application, such as gored and die-formed elbows, tees, laterals, pant wyes, reducers, rectangular to round transitions, pick-up hoods, blast gates, clean-outs, access doors, diverters, and many more

Many standard fitings are in stock at all times

- Custom components can be engineered for any purpose or specfic application

Available in many materials—meets a broad range of applications:

- Galvanized G60-G90[1]
- Paint Grip A-60[1]
- Poly-vinyl coated[1]
- Aluminum 3003 H-14[2]
- Stainless 304 or 316[3]
- Aluminized Steel
- Copper

Copper Spiral pipe

[1] ASTM A-653 • [2]ASTM B-316 • [3]ASTM A-240

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A Wide Range of Commercial & Industrial Applications

Spiral Pipe

***Broad range of applications*—**versatility:

- Commercial
- Industrial
- Chemical
- Underground
- Bulk materials handling

Applications of Spiral Pipe

The versatility of Spiral duct has lead to its use in a wide range of applications:

***Commercial*—**the primary use of Spiral duct in commercial applications is for HVAC. Spiral duct can now be found in numerous commercial applications including:

- Restaurants
- Churches
- Sports facilities
- Community centers
- Clinics and hospitals
- Schools and universities
- Retail stores and malls
- Community and entertainment facilities
- Office buildings and warehouses
- And many more

Spiral Duct in church blends in with ceiling design

***Industrial*—**Spiral pipe's ability to handle high positive and negative pressures has led to numerous industrial applications:

- HVAC
- Removal of chemical fumes and other environmental toxins
- Removal of dust and other airborne particulates
- Removal of manufacturing by-products such as sawdust and wood shavings

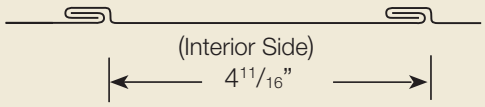
Spiral Pipe is used extensively in industrial applications

- Bulk material handling such as the loading of grain trucks and hoppers.

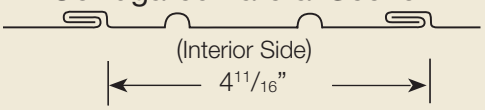
Spiral Vinyl-Coated Pipe

The chemical inertness of PVC combined with the strength of Spiral pipe make Vinyl coated duct ideal for chemical fume removal applications and for underground HVAC applications where strength and resistance to corrosive salts and other minerals found in backfill are prerequisites. Our vinyl-coated Spiral pipe is UL listed and manufactured from galvanized steel coated with a polyvinyl chloride material with an outside thickness of 4 mils and inside thickness of 1 mil standard. This is reversible for special purposes. External corrugations are standard for over 14" diameter for underground applications. Standard gauges are: 4" to 16" / 24 gauge, 17" to 24" / 22 gauge, 26" to 48" / 20 gauge.

Standard Lateral Section



Corrugated Lateral Section



Spiral Insulated Pipe

Our dual-wall Spiral insulated duct adds both thermal insulating and sound attenuating benefits to any air distribution system. This dual-wall product consists of inner and

Dual wall Spiral pipe saves energy and reduces noise. Shown without insulation.

Spiral Pipe

Fittings & Accessories for Every Application

outer Spiral pipes with a layer of glass fiber insulation sandwiched in between, thus reducing noise and conserving energy.

Material Handling & Truck Loading

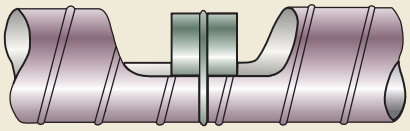
The ability of Spiral pipe to handle high pressures, its efficient airflow characteristics, and its low pressure loss make Spiral pipe ideal for bulk material handling applications. We offer a complete line of trailer loading accessories, including ball joints, diverter valves, quick disconnects, and air actuated gates. See pages 45-49 for components and technical data.

Typical Truck Loading application

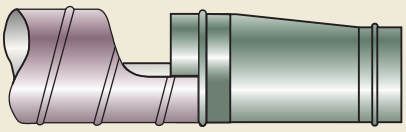
Fittings

Spiral Manufacturing offers a complete line of seam welded, slip-joint fittings designed especially for use with Spiral pipe. Standard fittings include many types of elbows, crosses, tees, laterals, reducers, and other components fabricated from standard 20 gauge steel (other gauges available).

Typical Pipe to Pipe Coupling Slip Joint



Typical Fitting to Pipe Slip Joint

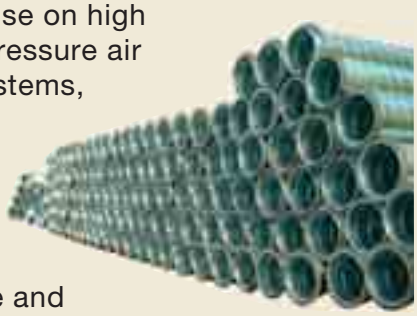


For more Information see page 23

Special Made Fittings

When you have requirements that cannot be met by our standard fittings, we can fabricate special fittings based on your specifications on a time and materials basis. Once accepted for production, orders for special fittings cannot be canceled, nor can the finished fitting be returned for credit. Please! Check your measurements carefully!

In conclusion Spiral pipe combines the economies of light gauge metal with a spiral lockseam construction that assures maximum strength and rigidity. Because of its superior structural strength, the ductwork requires fewer joints and hangers. Four plys of metal form a continuous interlocked reinforcing rib on the outside, which permits making long lengths of pipe in various diameters, and has a resistance to crushing approximately 2-1/2 times that of longitudinal lockseam or welded pipe. Optional corrugations are available which increase the rigidity of the pipe by approximately 300%.



Developed for use on high velocity, high-pressure air conditioning systems, Spiral pipe has gained wide acceptance for all types of high or medium pressure, above and below ground distribution systems, such as ventilation, dust removal, grain handling, carbon monoxide exhaust, and dual wall pipe for sound and thermal insulation. These are only a few of its diversified applications.

Standard length in all diameters is 10 feet. Any length between 6 and 20 feet cut at no additional charge. Sizes range from 3” to 18” @ 1” intervals and 20” to 80” @ 2” intervals.

For Physical Properites of Spiral Pipe and Technical Information, see inside front cover and Engineering Data pages 50 thru 60.

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Selection Guide

Select Product from Diagram and Look Up Page Number from Table

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Flanged connections	24-25
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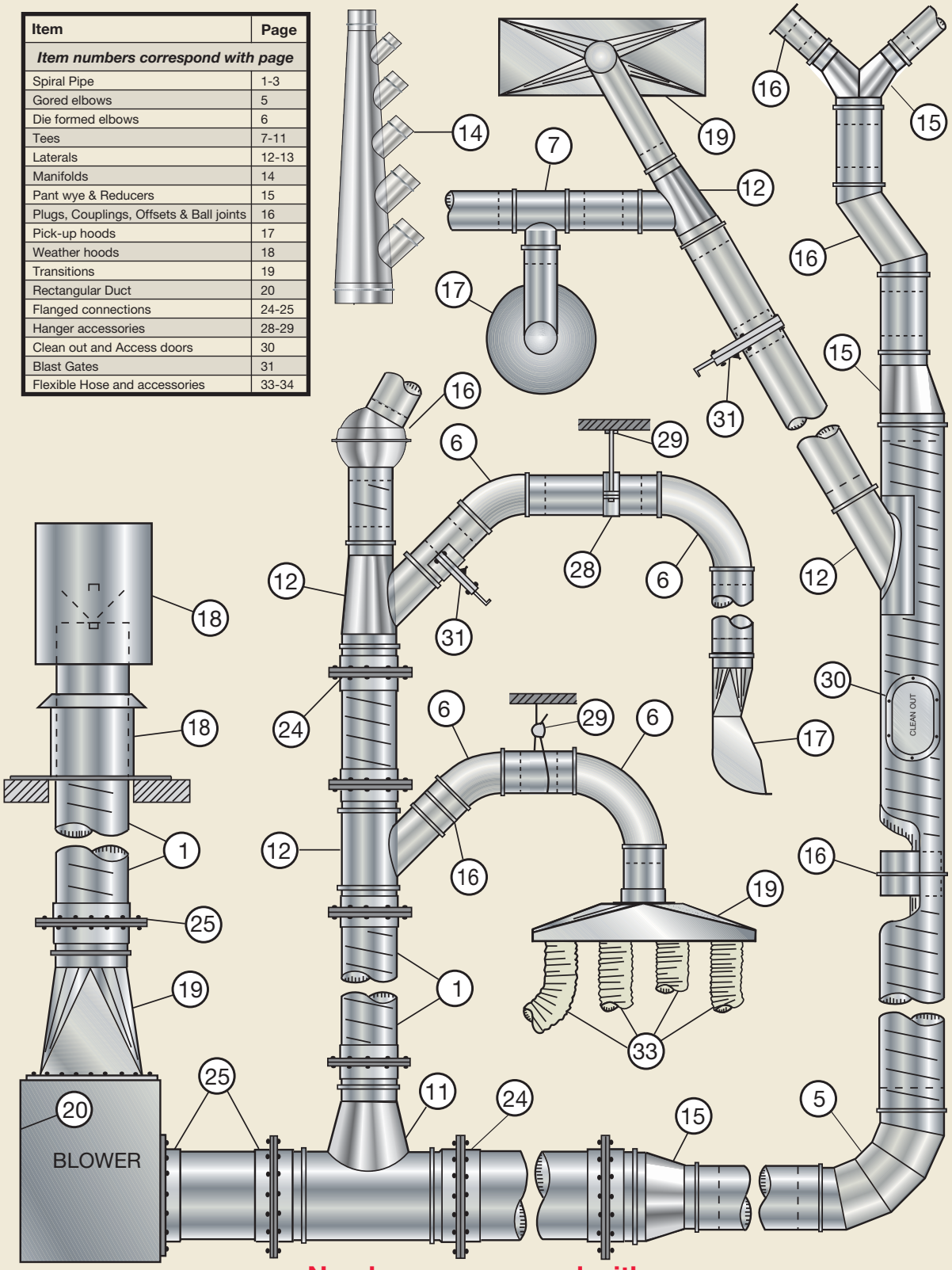


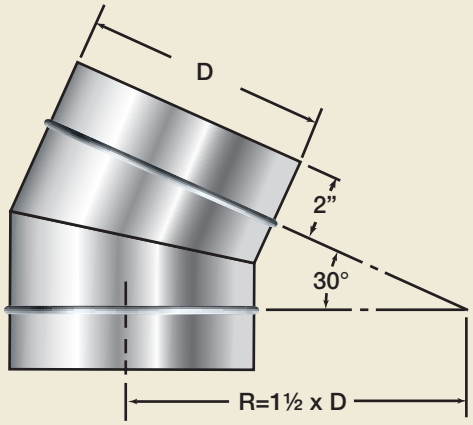
Numbers correspond with page

Elbows

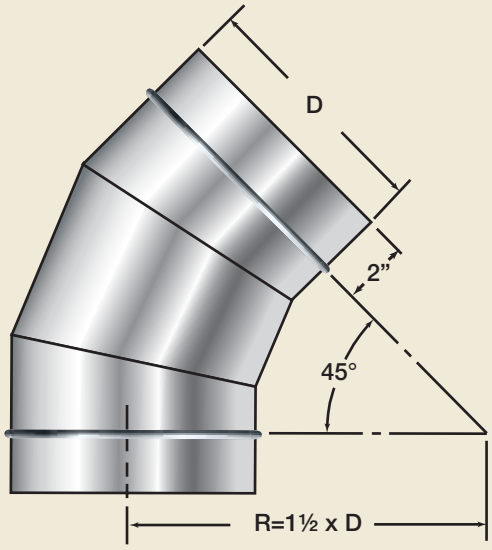
Standard & Reducing Elbows are available in any size and degree with optional radius

Typical Standards Shown

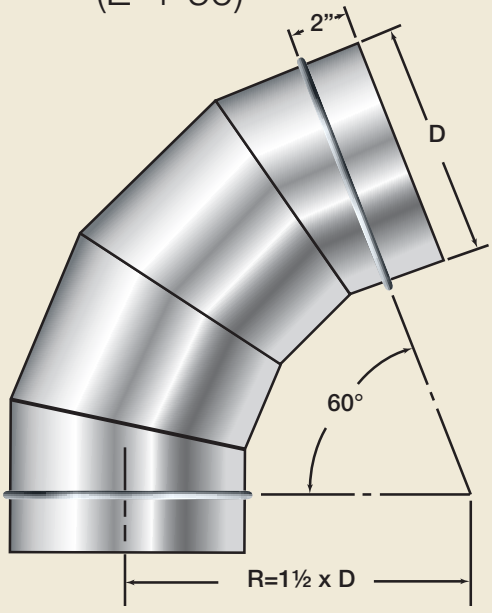
30° Gored Elbow (E-2-30)



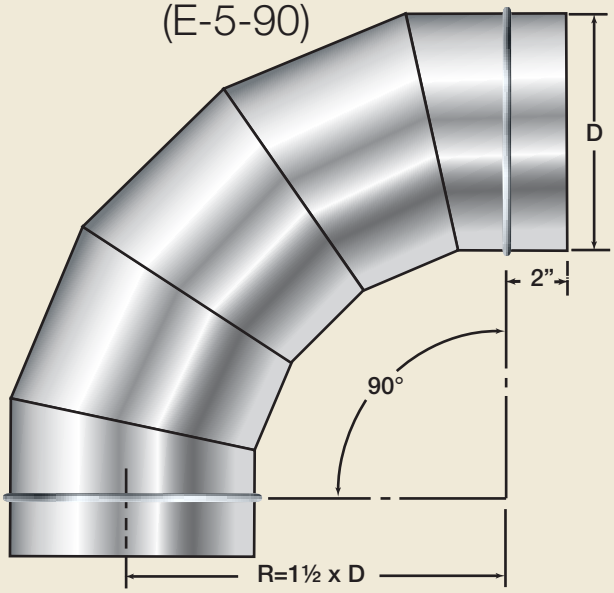
45° Gored Elbow (E-3-45)



60° Gored Elbow (E-4-60)



90° Gored Elbow (E-5-90)



Dimensions shown are standard. Longer radius or more gore sections are available. For other than standard, consult factory.

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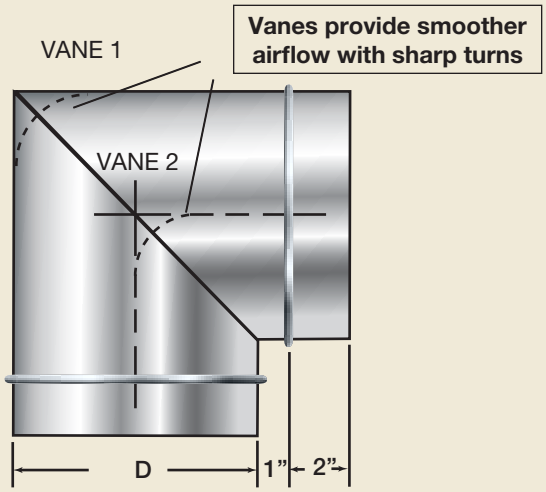
Elbows

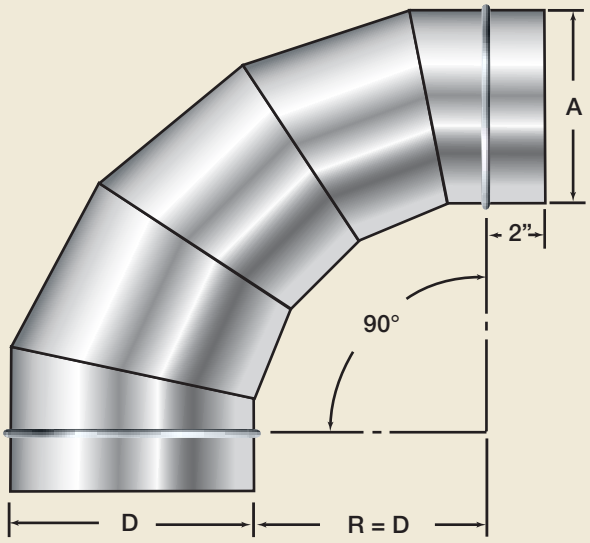
Special Application Elbows for sharp turns, changing diameters & improved airflow

90° Mitered Elbow 2-Piece (E-2-M-90)



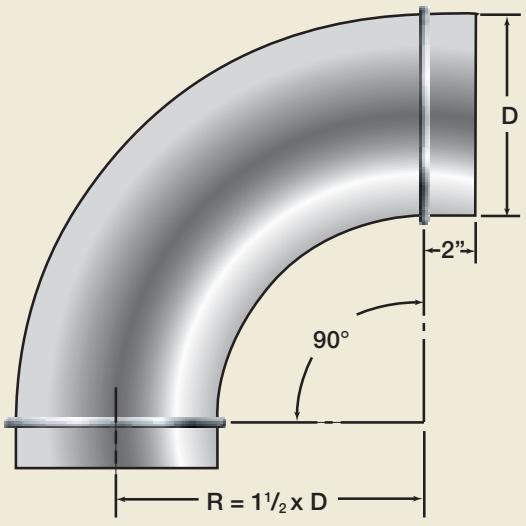
3” to 7” = 1 vane
8” to 24” = 2 vane
For larger sizes consult factory

Reducing Elbow (RE-5-90)



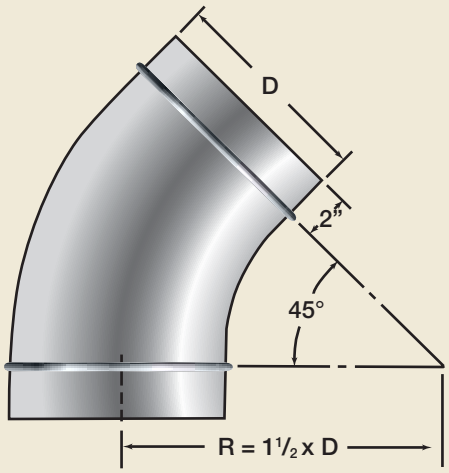
Available in any size and degree with optional radius

Die-Formed Elbow (E-1-90)



Die-Formed Elbow (E-1-45)

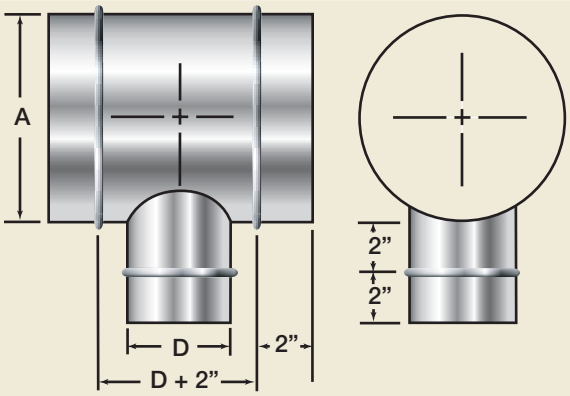
Die-Formed Elbows allow for smoother airflow
See data on page 51



Die-formed elbows from 20 gauge are avaliable in both 90° and 45°. Ten standard diameters from 3” to 12” are available. 14” are available on special order.

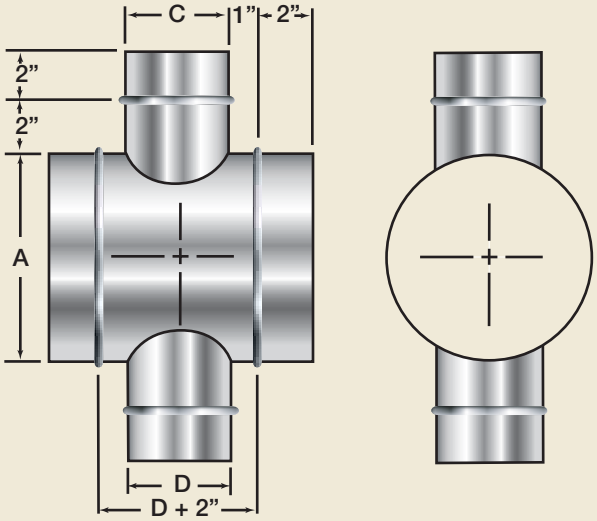
Tee's – 90°

Plain Tee, 180° Cross Tee & 135° Cross Tee



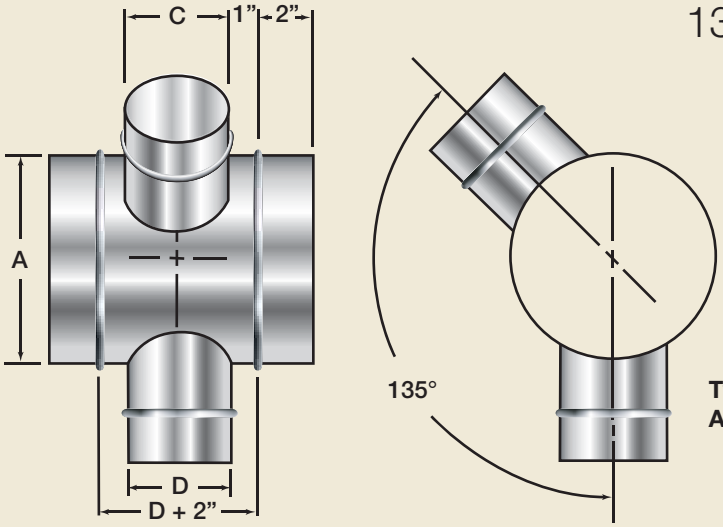
Plain Tee
(T-1)

Dimensions to be listed in order of A, D



180° Cross Tee
(T-2-180)

Dimensions to be listed in order of A, C, D



135° Cross Tee
(T-2-135)

Typical radial angle shown.
Any angle available.

Dimensions to be listed in order of A, C, D

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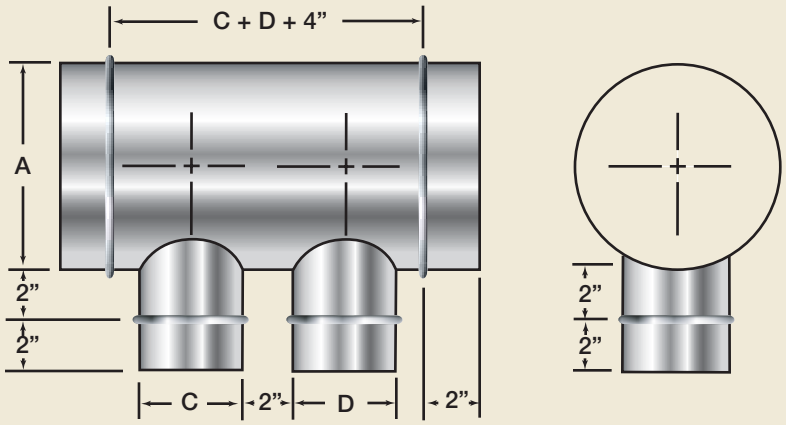
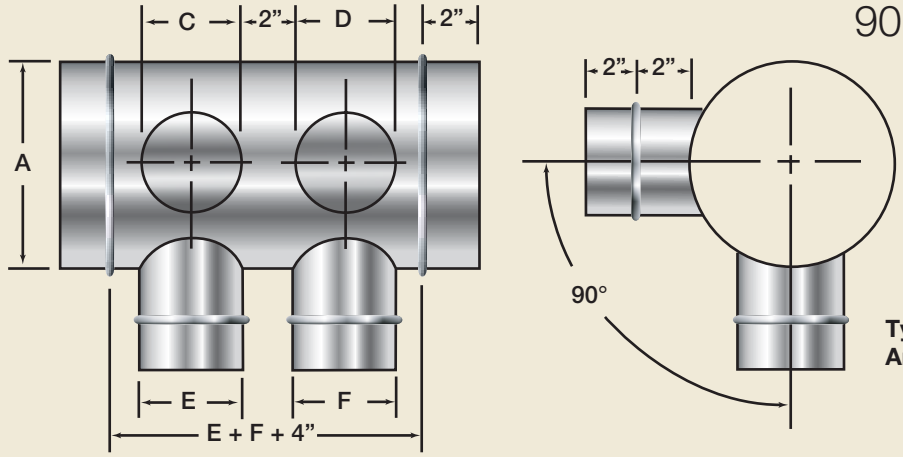
Double Parallel Tee, 90° 4-Branch Cross & 135° 4-Branch Cross



Double Parallel Tee (T-2-P)

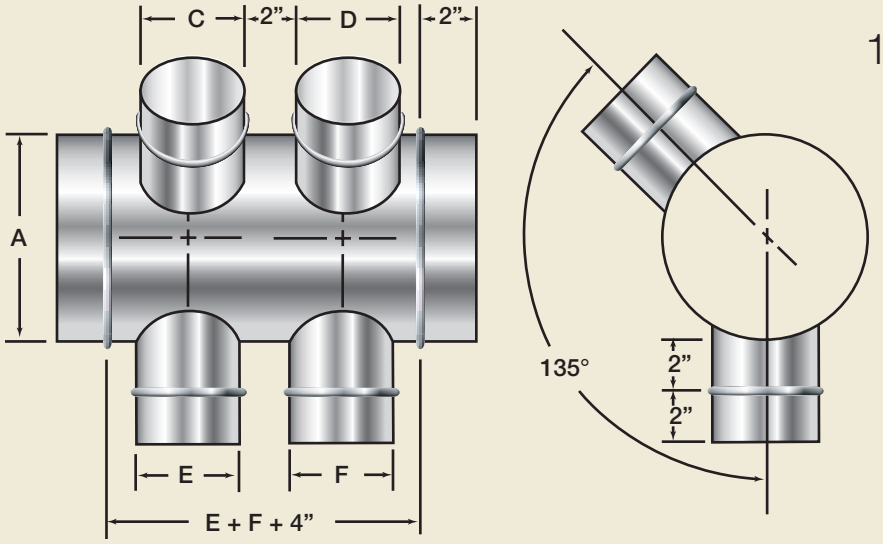
Dimensions to be listed in order of A, C, D



90° 4-Branch Cross (T-4-90)

Typical radial angle shown. Any angle available.

Dimensions to be listed in order of A, C, D, E, F



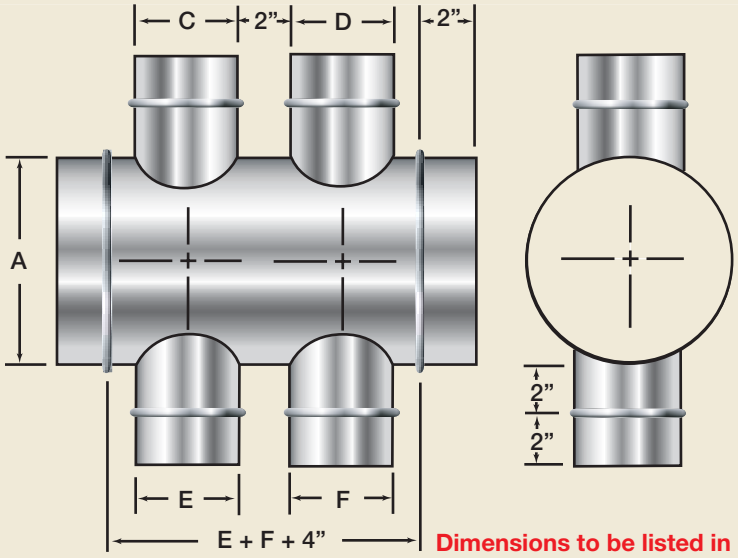
135° 4-Branch Cross (T-4-135)

Typical radial angle shown. Any angle available.

Dimensions to be listed in order of A, C, D, E, F

Tee's – 90°

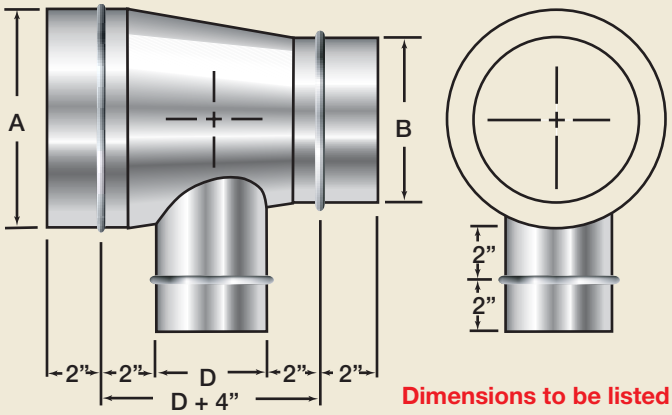
180° 4-Branch Cross Tee, Reducing Tee & 180° Reducing Cross Tee



180° 4 Branch Cross (T-4-180)

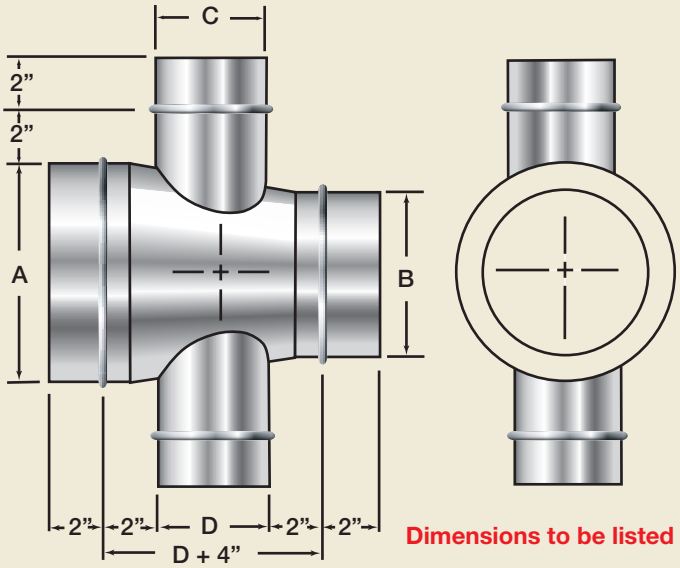
Typical radial angle shown.
Any angle available.

Dimensions to be listed in order of A, C, D, E, F



Reducing Tee (T-1-R)

Dimensions to be listed in order of A, B, D



180° Reducing Cross (T-2-R-180)

Typical radial angle shown.
Any angle available.

Dimensions to be listed in order of A, B, C, D

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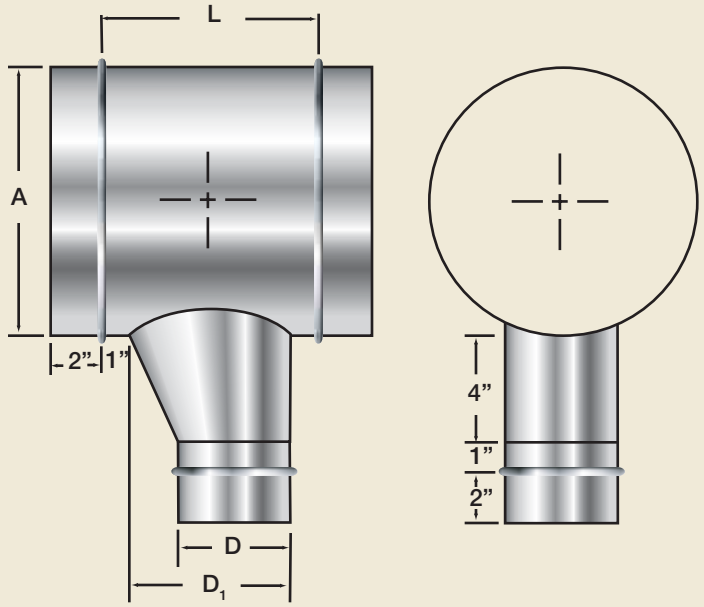
Phone: 763-755-7677 • 800-426-3643 • Fax: 763-755-6184

Airflow Tee & Reducing Airflow Tee

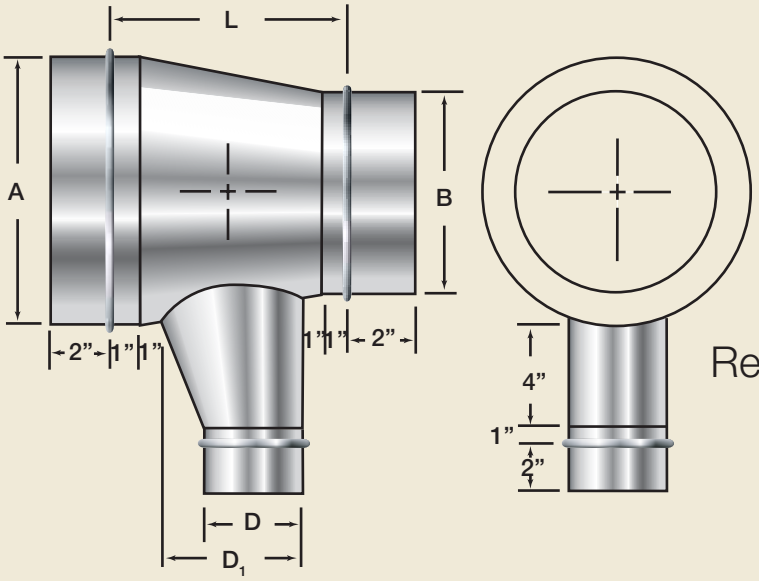
Airflow Tee
(AFT-1)



Dimensions to be listed in order of A, D

Engineering Note

Recommended for HVAC only.
Close coupling of elbows and branch fittings should be avoided if at all possible. The total pressure loss of two close-coupled fittings will generally be greater than the sum of the individual fitting losses. For example: both the 45° lateral and 45° elbow individually are proved to be low loss fittings. However, when they are joined to form a 90° branch, the combined performance is not as good as a conical tee or the airflow tee. This is a particularly important point to consider because the *airflow tee* (this page) *or conical tee* (next page) is less expensive and is more compact than the combination lateral-elbow. For best economy, the designer should use the conical tee or combination tee when low branch losses are important; and the straight 90° tee should be used when a higher loss fitting can be tolerated.

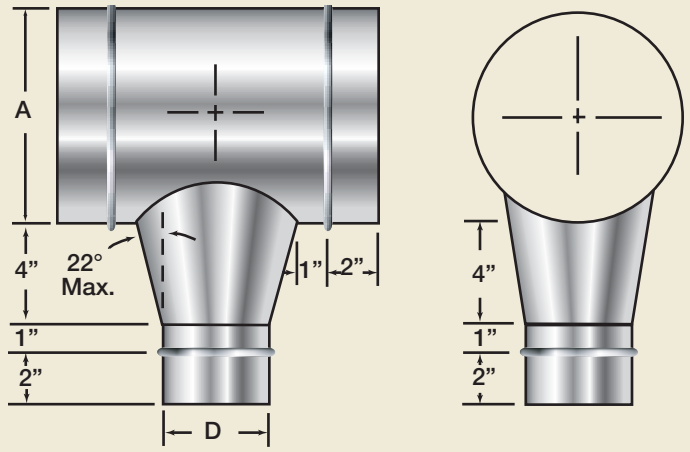


Reducing Airflow Tee
(AFT-1-R)

Dimensions to be listed in order of A, B, D

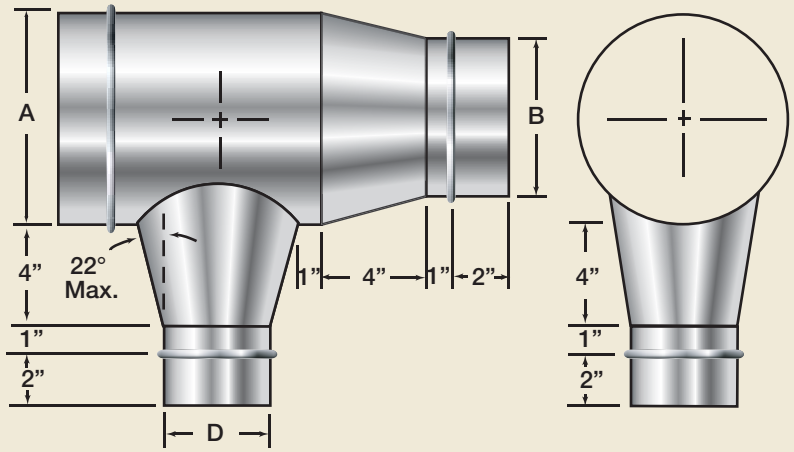
Tee's – 90°

Conical Tee, Conical Reducing Tee & Bullhead Tee



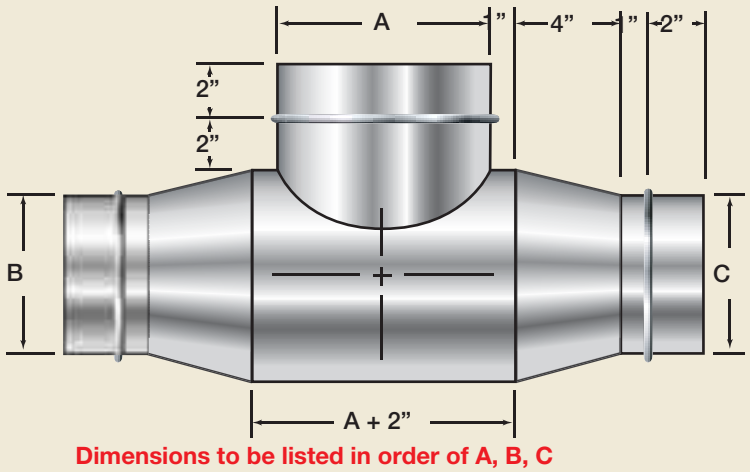
Conical Tee (T-1-C)

Dimensions to be listed in order of A, D



Conical Reducing Tee (T-1-C-R)

Dimensions to be listed in order of A, B, D



Bullhead Tee

Dimensions to be listed in order of A, B, C

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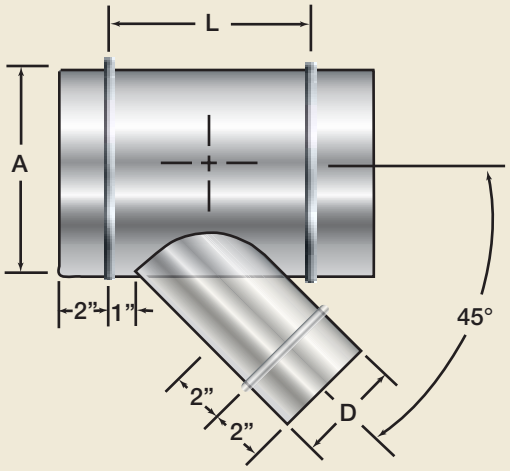
45° Lateral, Tapered Reducing Lateral, 30° Lateral & Saddles

Available in any angle. Standard is 45°

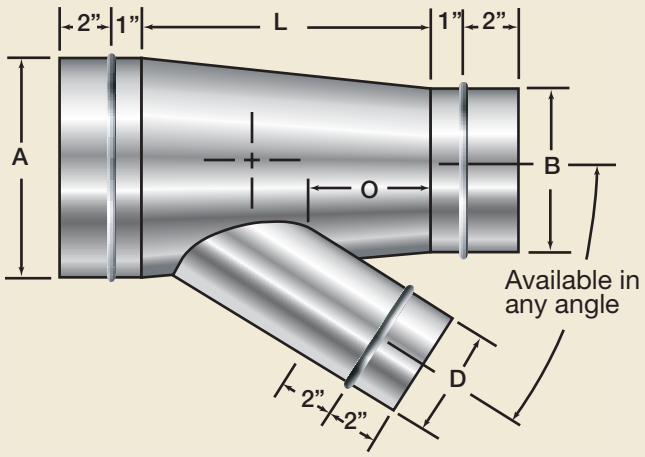
45° Lateral (L-1)



L = (1.414 x D) + 2

Dimensions to be listed in order of A, D

Tapered Reducing Lateral (Standard) (L-1-R)

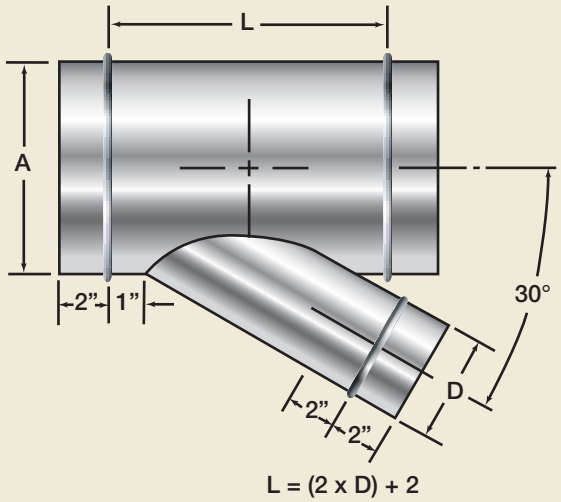


L and O vary with A, B, D (Consult Factory)

Dimensions to be listed in order of A, B, D

Available in any angle. Standard is 45°.

30° Lateral (L-1-30)

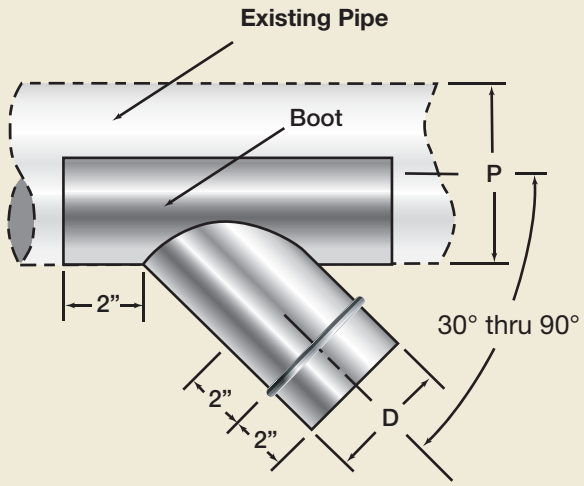


L = (2 x D) + 2

Dimensions to be listed in order of A, D

Saddles

Available with or without boot



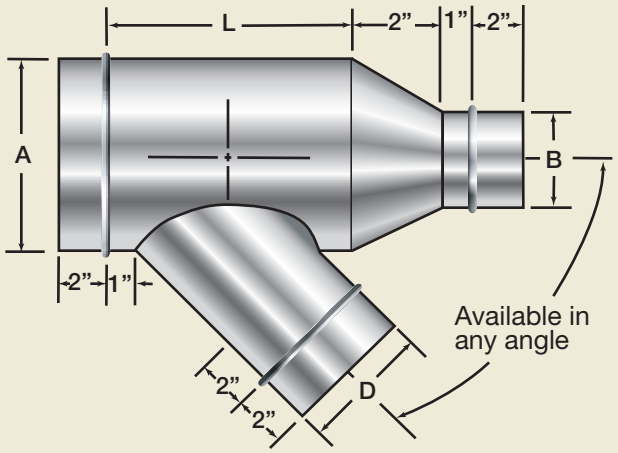
Dimensions to be listed in order of D, P.
Standard boot has 2" perimeter around branch.

Laterals

Optional 45° Reducing Lateral, 45° Double Parallel Lateral & Reducing Lateral Cross

Available in any angle

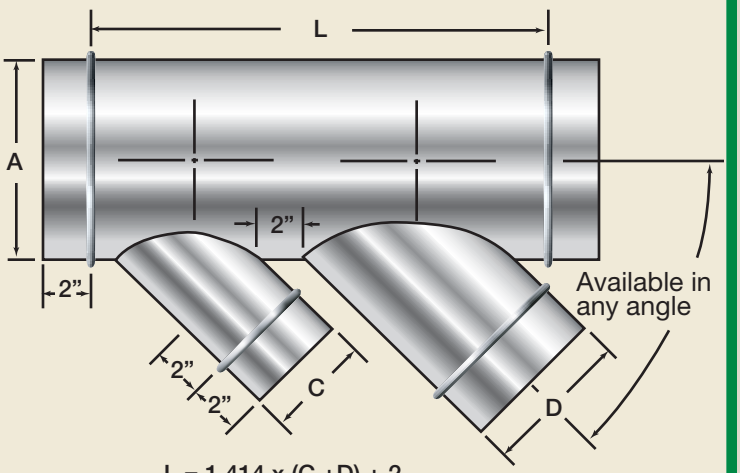
Optional 45° Reducing Lateral (O-L-1-R)



L = (1.414 x D) + 2

Dimensions to be listed in order of A, B, D

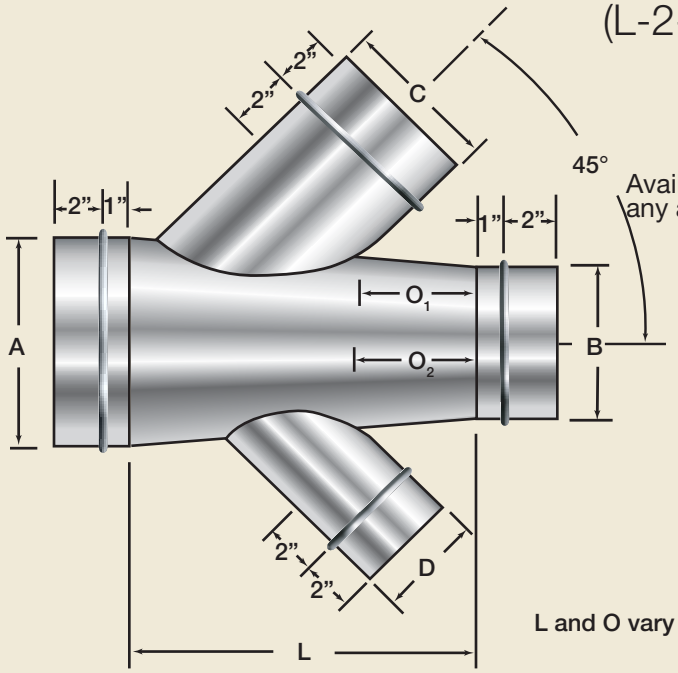
45° Double Parallel Lateral (L-2)

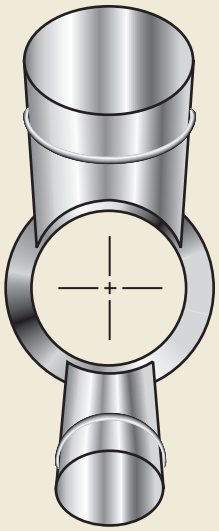


L = 1.414 x (C +D) + 2

Dimensions to be listed in order of A, C, D

Reducing Lateral Cross (Full Taper Standard) (L-2-R) @ 180°





L and O vary with A, B, C, D (Consult Factory)

Dimensions to be listed in order of A, B, C, D

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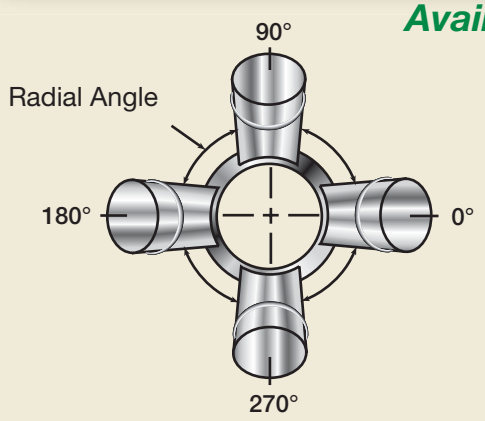
Multi-Branch Laterals (Manifolds)

Available in any angle

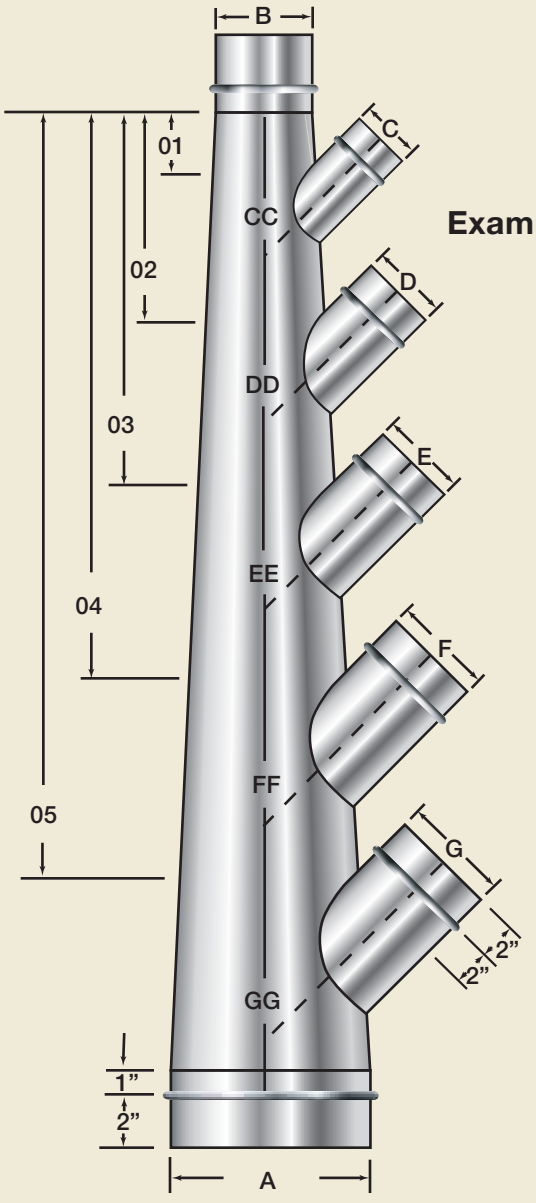


How to Order

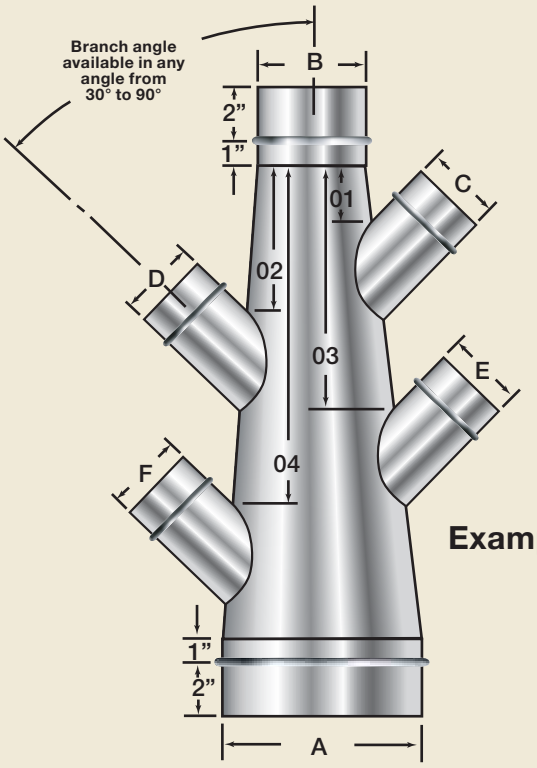
To order a multi-branch lateral (or manifold), first give the dimensions of A, B, C, D, E, F, G, etc. Then give the branch angle (45° standard) and the radial angles if needed.

Example 1: 12 x 6 x 3 x 4 x 5 x 6 x 7 with 45° branch angles. All branches at radial angle 0°

Example 2: 8 x 6 x 4 x 4 x 4 x 4 with 45° branch angles. Branches C and E at radial angle 0°. Branches D and F at radial angle 180°.



Example 1

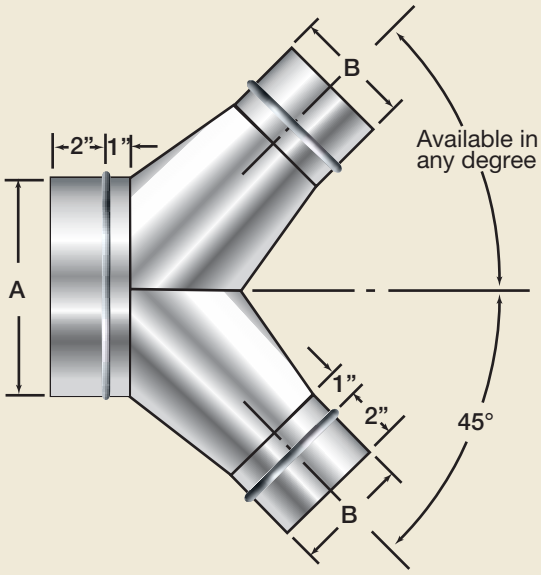


Example 2

Pant Wyes / Reducers

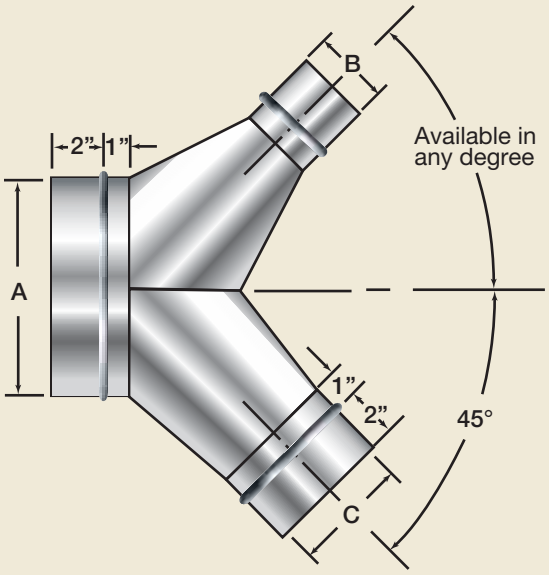
Y-Branch or Pant Wye, Reducing Y-Branch, Concentric Reducer & Eccentric Reducer

Y-Branch or Pant Wye (Y-2)



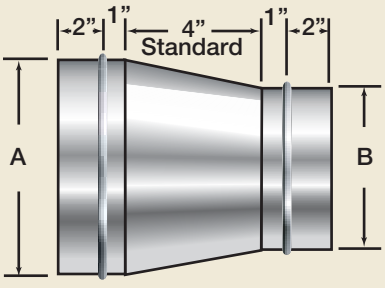
Dimensions to be listed in order of A, B

Reducing Y-Branch (Y-2-R)



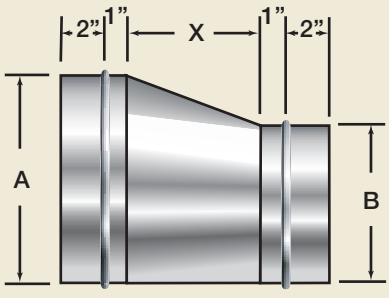
Dimensions to be listed in order of A, B, C

Concentric Reducer (C-1-R)



Any length available.
Dimensions to be listed in order of A, B

Eccentric Reducer (E-C-1-R)



X varies with A and B. Consult factory.
Dimensions to be listed in order of A, B

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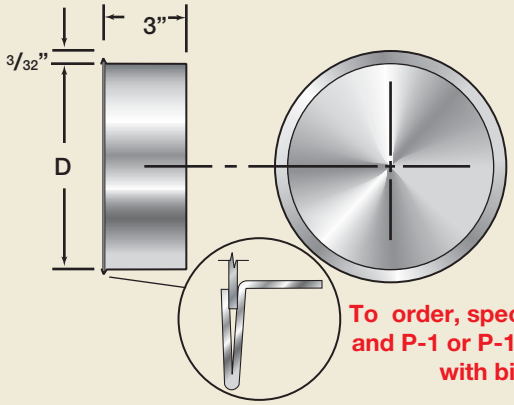
Plugs & Caps, Couplings, Offsets, Ball Joints & Register Saddles

Plugs & Caps

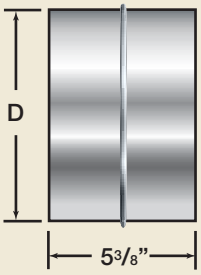
Pipe Plug (P-1) fits into pipe
Fitting Cap (P-1-F) fits over fitting



To order, specify "D" dimension and P-1 or P-1-F. Also available with bird screen.

Couplings

Pipe Coupling (C-1) fits into pipe
Fitting Coupling (C-1-F) fits over fitting



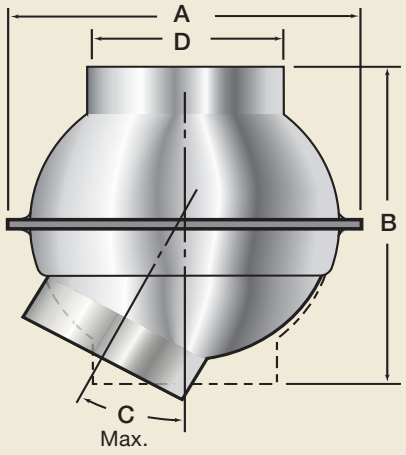
To order, specify "D" dimension and C-1 or C-1-F.

Table 17-1 Ball Joint Dimensions

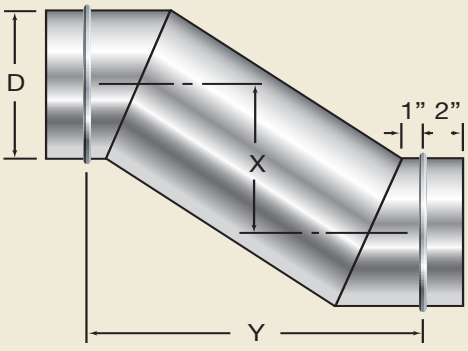
D	A	B	C	Wgt. Lbs.
3"	5 3/8	4 3/4	23°	1
4"	7 1/2	6 1/2	23°	1.75
5"	9	7 7/8	27°	2.5
6"	7 1/2	8 7/8	27°	3
7"	10 3/8	7 7/8	22°	4
8"	13	11	27°	7
9"	14 5/8	12	27°	8
10"	14 5/8	11 1/4	22°	9
12"	16 1/2	12 1/4	20°	10

Spun steel galvanized ball joints provide flexibility in ducts that serve moving equipment such as cutter heads. The duct can swing through an arc while maintaining exhaust flow. Available in 3" through 12" diameter.

Ball Joint

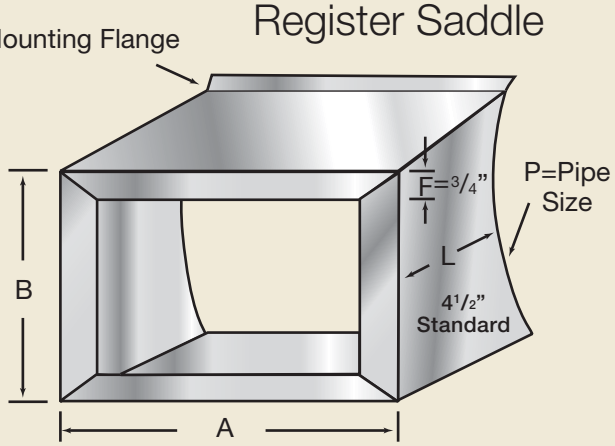


Offset



List dimensions in order of D, X, Y.

Register Saddle

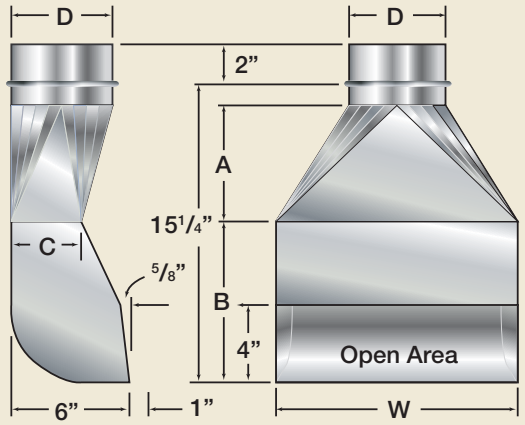


List dimensions in order of A, B, P. L is available in any length.

Pick-Up Hoods

Floor Sweeps, Dust Nozzles & Bellmouths

Floor Sweeps

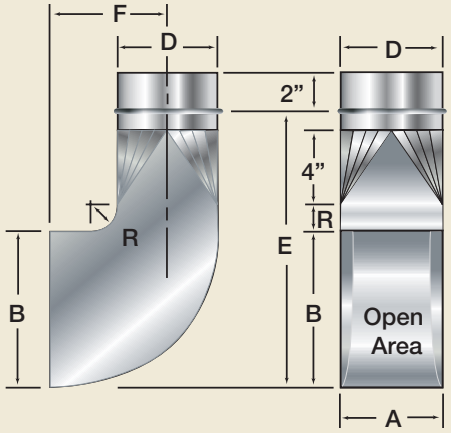


As the leader in the industry, Spiral Manufacturing Co., Inc. does not put doors on the open area of Floor Sweeps for safety reasons. The use of Blast Gates 42″ above the floor saves severed fingers and back injuries.

Sizes Available				
D	**W**	**A**	**B**	**C**
4”	10	6	8¼	3½
5”	20	6	8¼	3½
6”	20	6	8¼	3½

Other sizes are available on request

Dust Nozzles

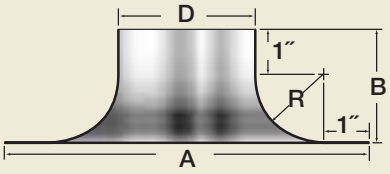


Radial Arm Saw hoods along with Chop Saw Hoods are designed to be located behind the sawblade in a fixed position. All standard hoods are made of 18 gauge galvanized steel.

Sizes Available					
D	**A**	**B**	**E**	**F**	**R**
4”	4	8	14½	5½	1½
5”	5	8	14½	6	1½
6”	6	10	16½	7	2

Other sizes are available on request

Bellmouths



Bellmouth fittings are designed to the highest engineering standards for maximum performance. They are used as a take-off for a fast, solid, and highly efficient connection. This conversion fitting, from a flat plenum or duct into Spiral pipe greatly reduces turbulence and noise. The pressure drop characteristics are superior to any other design.

Standard Radius Bellmouth									
D	**A**	**B**	**R**	**Wt. Lbs.**	**D**	**A**	**B**	**R**	**Wt. Lbs.**
3”	8	2.5	1.5	1.2	**10”**	16	3	2	2.4
4”	9	2.5	1.5	1.3	**11”**	19	4	3	3.6
5”	10	3	2	1.5	**12”**	20	4	3	3.8
6”	12	3	2	1.7	**14”**	22	4	3	4.4
7”	13	3	2	1.9	**16”**	26	5	4	6.5
8”	14	3	2	2.0	**18”**	28	5	4	7.1
9”	15	3	2	2.2	**20”**	30	5	4	7.3

See page 19 for more hoods.

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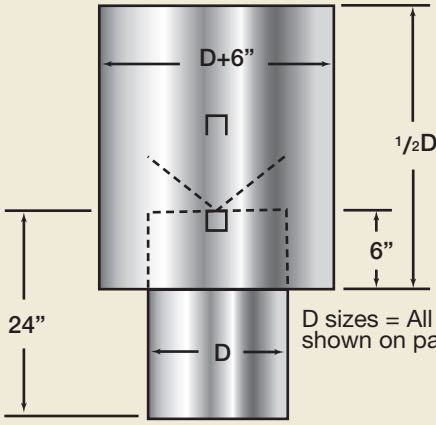
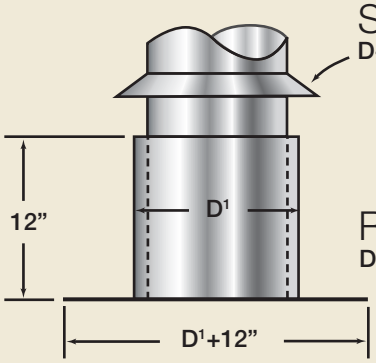
Weather Hoods



Sky Blast (SB)

D sizes = All standard pipe sizes shown on page 34

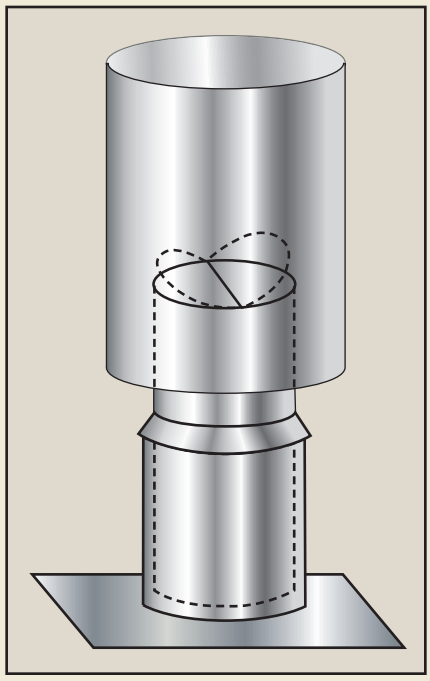


Storm Collar (SC)

D+4"

Roof Flashing (FL)

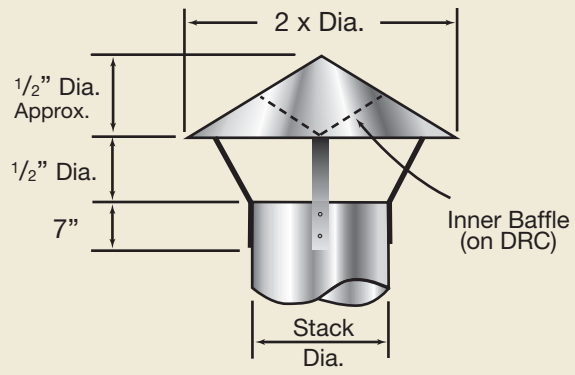
D^1 = D+2"



Shown flat. Pitched is also available

Semi-circular flaps (butterfly damper) cover the exhaust stack when fan is off. When fan is on, flaps are forced out of the way to provide a clear path for air movement. The built-in gutter system is designed to prevent rain and snow from entering the stack. Made from galvanized Spiral pipe for strength and durability; available in most sizes. Pre-assembled for immediate installation. Available with or without Vanstone flange. See pages 24 and 25.

Rain Cap



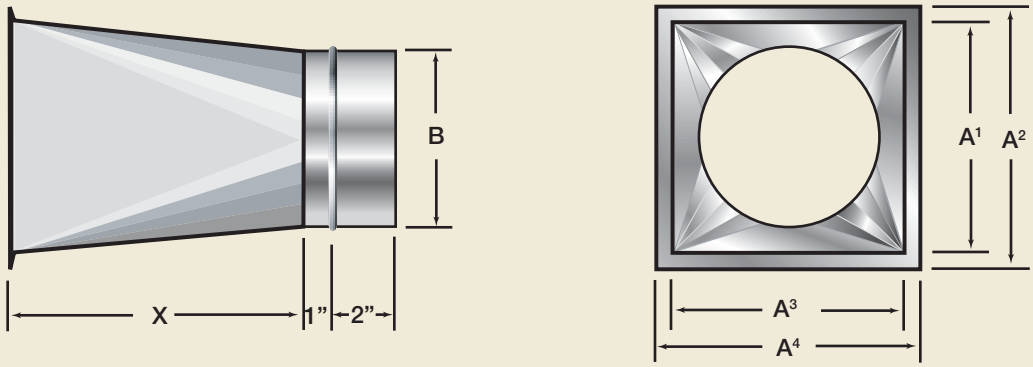
(SRC) Single Rain Cap (no inner baffle)
(DRC) Double Rain Cap (inner baffle)
Available with Bird Screen

Rectangular to Round Transitions

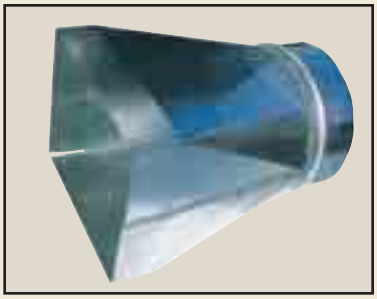
Rectangular to Round Standard & Offset

Rectangular to Round (Standard)

Shown with formed flange out

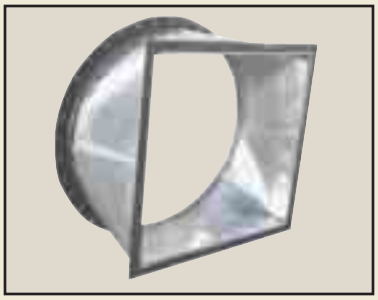


When ordering with flange, list dimensions in order of A^1, A^2, A^3, A^4, B, X.
When ordering without flange, list dimensions in order of A^1, A^3, B, X.



Raw (plain end)

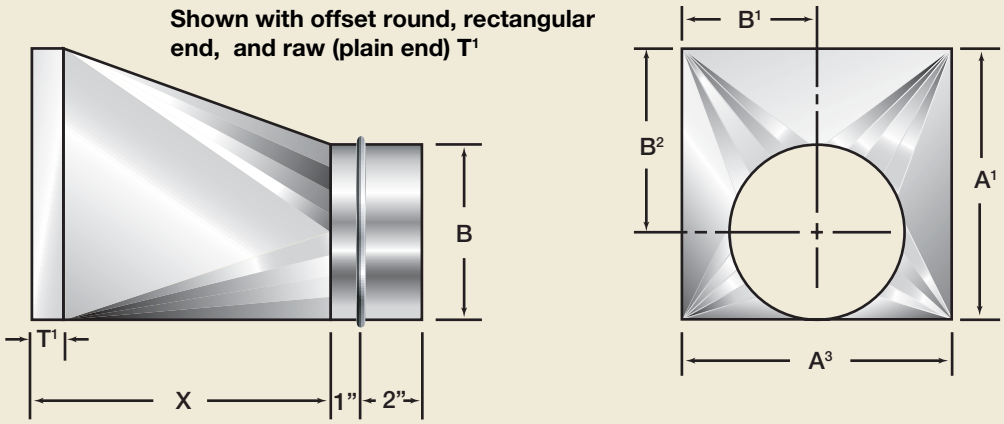
Formed Flange Out



Angle Iron Flange

Rectangular to Round (Offset)

Shown with offset round, rectangular end, and raw (plain end) T^1



When ordering with flange and offset round, list dimensions in order of A^1, A^2, A^3, A^4, B, X, B^1, B^2.
When ordering without flange, list dimensions in order of A^1, A^3, B, X, B^1, B^2, T^1.
For Offset Square to Round a print is required.

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Rectangular Duct in Many Configurations

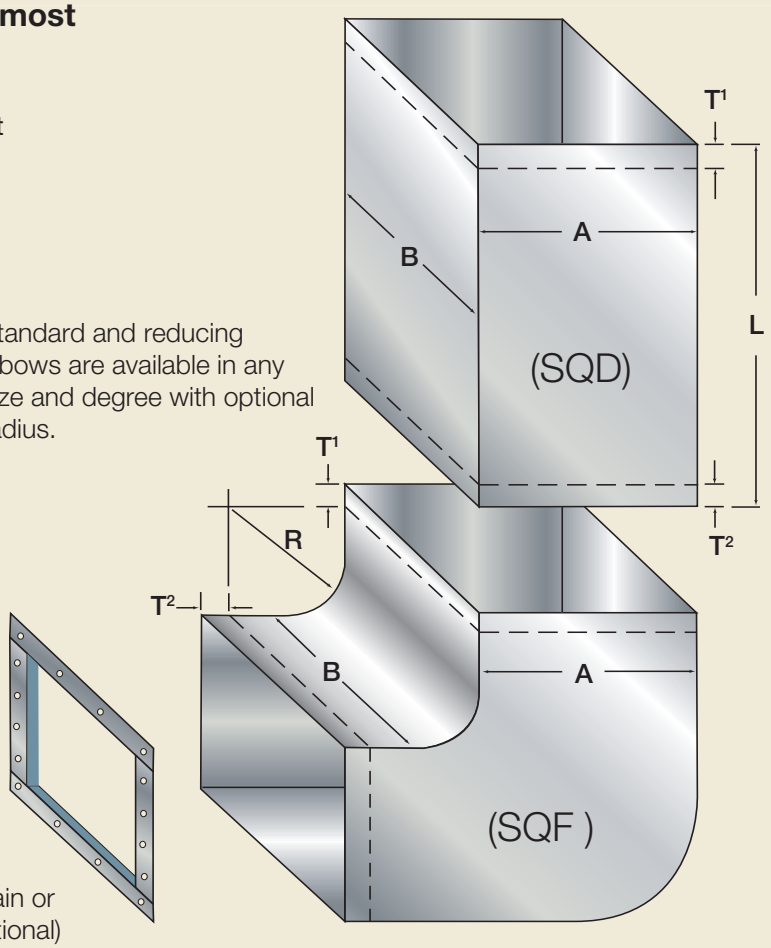
Rectangular duct is available in almost any size or shape.

Ends are available in:

- Raw (plain end) — T^1 & T^2 remain straight
- Formed Flange — T^1 & T^2 are turned out
- Angle Iron Flange — 1", $1\frac{1}{4}$", $1\frac{1}{2}$" & 2"
- Ductmate 35 and more

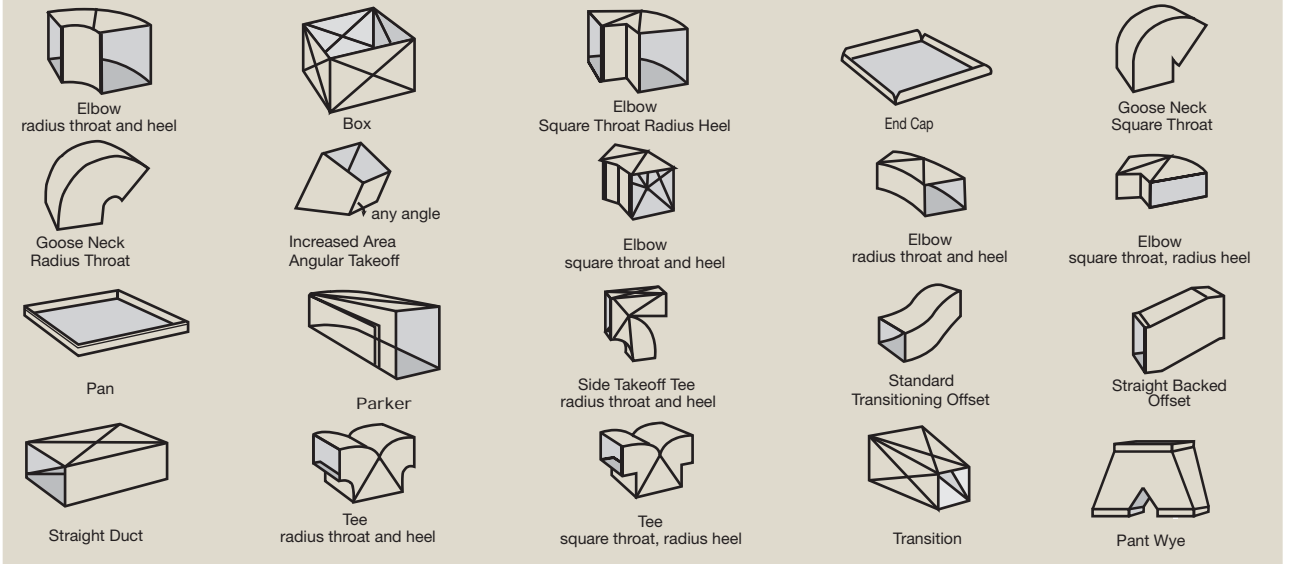
No job is too large or too small for Spiral Manufacturing; and no matter what size your job, you can expect the highest quality and the best service.

Standard and reducing elbows are available in any size and degree with optional radius.



Angle iron plain or punched (optional)

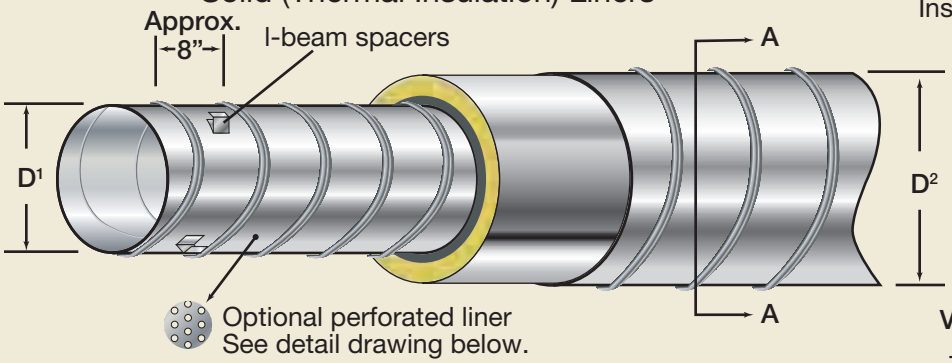
List dimensions in order of A, B, R, L, T^1, T^2

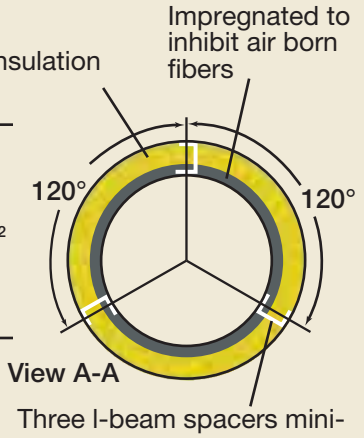


Dual Wall Pipe

Dual Wall Insulated Spiral Pipe & Fittings

Available in Perforated (Acoustical) Liner or Solid (Thermal Insulation) Liners





Three l-beam spacers minimum at approx. 120° centerline spot welded to inner duct.

Duct liner absorbs equipment and air rush noises over a broad spectrum of sound. Glass fiber construction traps noise and dissipates it within the fiber matrix. Air is delivered, not noise. It also performs as a thermal insulation to conserve energy.

Application Note

Zinc on galvanized pipe melts at 788° F.
The Manual of Industrial Ventilation Recommended Practice, 23rd Edition, suggests that operating temperatures not exceed 400° F.
Standard duct liner maximum temperature rating 250° F.
R-value of duct liner per inch of thickness = 3.6.
Aluminized Type 1 - 1250° F.

Performance Chacteristics

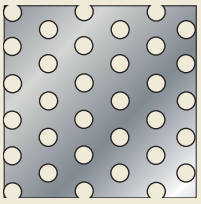
(Sound Absorption)

DENSITY lbs. per cu. ft.	Thickness	Noise Reduction Coefficients at Frequencies						
		125	250	500	1000	2000	4000	NRC*
1.5	1"	.17	.52	.57	.69	.82	.86	.65
	1 1/2"	.23	.62	.74	.82	.87	.88	.75
	2"	.32	.70	.83	.91	.92	.91	.85
2.0	1/2"	.08	.42	.35	.46	.61	.75	.45
	1"	.19	.54	.61	.74	.86	.90	.70
	1 1/2"	.25	.64	.78	.87	.94	.92	.80
	2"	.33	.76	.88	.94	.95	.94	.90
3.0	1/2"	.10	.40	.37	.53	.68	.79	.50
	1"	.21	.57	.70	.89	.95	.97	.80
	1 1/2"	.27	.66	.85	.94	.97	.98	.85
	2"	.36	.79	.96	.99	.98	99	.95

**Overall Noise Reduction Coefficient (NRC)*

Perforated Section

(Actual Size)



3/32"@ 3/16" centers (staggered). 33 holes per sq. inch. Open area 23%.

Thermal Conductance

DENSITY lbs. per cu. ft.	K	R
1.5	.29	3.4
2.0	.27	3.7
3.0	.24	4.2

All values are measured at 75° mean temperature.

K factor is expressed as Btu/in./ft² /°F.

R is the reciprocal of K.

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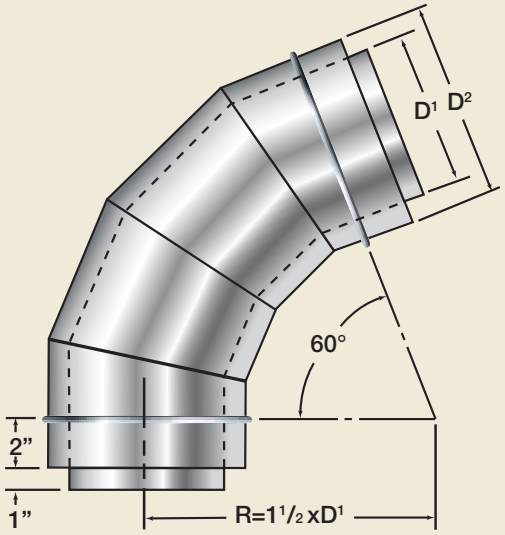
Dual Wall 60° & 90° Elbows, Dual Wall Plain Tee & Dual Wall Reducing Tee.

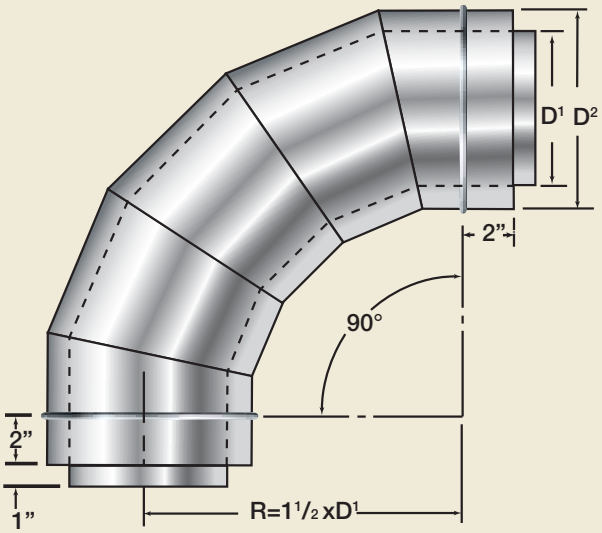
Dual Wall 60° Elbow (DW-E-4-60)

All 90° elbows are of 5 piece construction, and all 45° elbows are of 3 piece construction. Elbow centerline radius is not less than 1½ times the inside duct diameter.



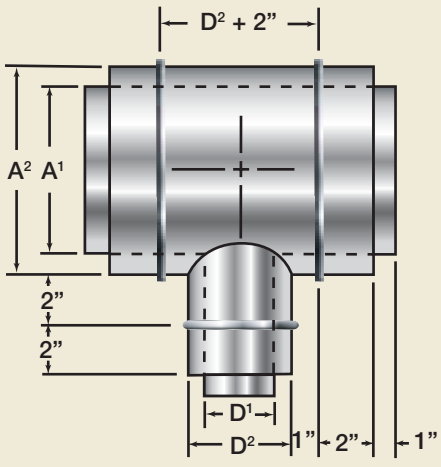
When ordering, list dimensions in order of: D^1, D^2

Dual Wall 90° Elbow (DW-E-5-90)



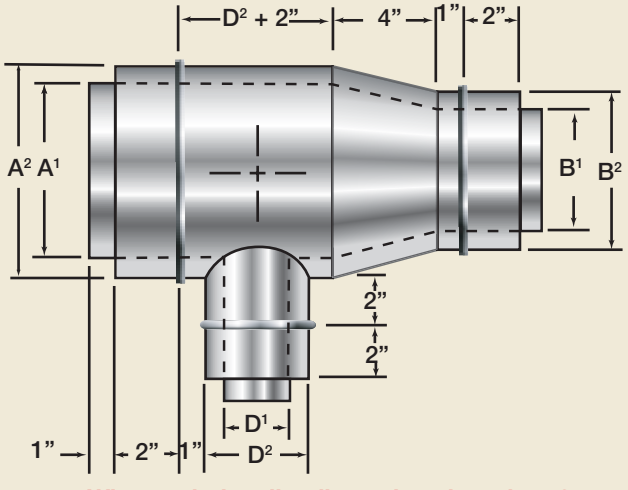
When ordering, list dimensions in order of: D^1, D^2

Dual Wall Plain Tee (DW-T-1)



When ordering, list dimensions in order of: A^1, A^2, D^1, D^2

Dual Wall Reducing Tee (DW-T-1-R)



When ordering, list dimensions in order of: A^1, A^2, B^1, B^2, D^1, D^2

All fittings in this catalog are available in dual wall construction. See examples above.

Installation

Slip Joints & Flange-to-Flange Joints

Spiral pipe is designed to be easy to install: all pipe ends are female, and all fitting ends are male, allowing pipe and fittings to easily slip together. There are several methods of joining Spiral pipe and fittings, depending on your application and your applications requirements.

Slip Joints

Slip joints are the simplest method of joining Spiral pipe:

Fitting-to-fitting joints (male to male) require a separate coupling, C-1-F; or a short, hand-cut section of Spiral pipe can be used as a coupling for quick, *in-the-field* connections.

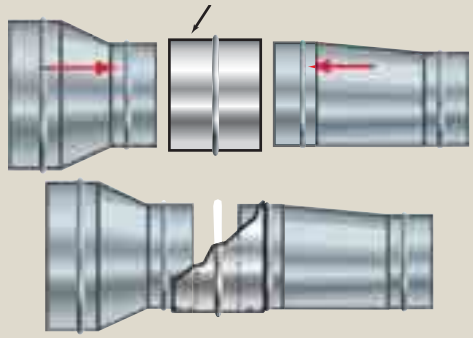
Pipe-to-pipe joints (female to female) also require a separate C-1 coupling.

Pipe-to fitting joints slip together without the need of a separate coupling.

Slip joints are fastened with screws or pop-rivets, and duct sealant or sealant tape (page 27) when additional air tightness is required. (The screws or rivets hold the pipe in place as the sealant cures.) The standard recommendation is for screws or pop-rivets to be used at a maximum of 15" intervals with no fewer than three screws or pop-rivets per joint. **Spiral Manufacturing** recommends a maximum interval of 6".

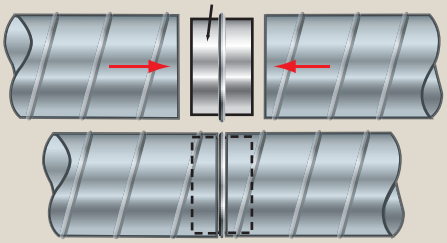
Fitting to Fitting slip joint

Coupling: Use standard C-1-F coupling or, in the field, cut a short length of spiral pipe.



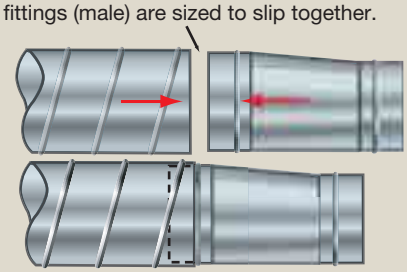
Pipe to Pipe slip joint

Coupling: Use standard C-1 coupling. The C-1 coupling is also used with flexhose.



Pipe to Fitting slip joint

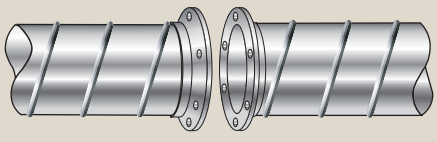
No Coupling: Pipe sections (female) and fittings (male) are sized to slip together.



Flange-to-Flange Joints

Flange-to-flange joints are widely used to connect pipes in dust and fume control applications, in outdoor applications, and for additional strength in high positive or high negative pressure applications. Flange-to-flange joints are fastened with bolts for permanent installations and for installations where the pipe must mate with fans or other air moving equipment. Flange clamps are used when there is a need for frequent, or occasional, maintenance or cleaning. Flange ends are fabricated by using *angle rings* (p. 25) to create a Vanstone Flange connection (p. 24).

Flange to Flange Joint



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Field Installation of Vanstone Flanges

Spiral Manufacturing offers professionally mounted Vanstone flanges on Spiral pipe and fittings. For most installations, this is the easiest and most secure option. There may be times, however, when Vanstone flanges must be mounted at the installation site. We have included mounting instructions below to assist you.

Step 1

Slip flange over Spiral ductwork allowing duct to extend 1/2" beyond the face of the flange. Measure to ensure the flange is square to the duct. Secure flange in place with 3 or 4 C-clamps.

Step 2

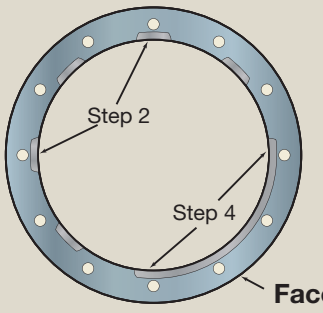
Peen 4 tabs about 1" wide and 90° apart, working from the inside of the flange. The edge of the flange acts as a break. Do not cut, slice, or hammer directly on the end of the duct.

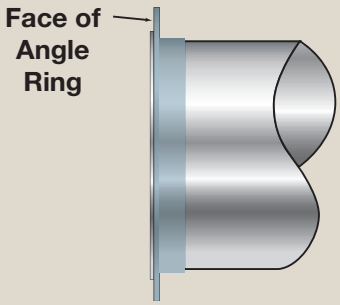
Step 3

Rotate duct 45° and peen 4 more tabs about 1" wide and 90° apart. There should now be a total of 8 tabs bent over.

Step 4

Peen remaining edge of duct over flange. Flange is ready to be bolted.





See Page 25 for sizes.

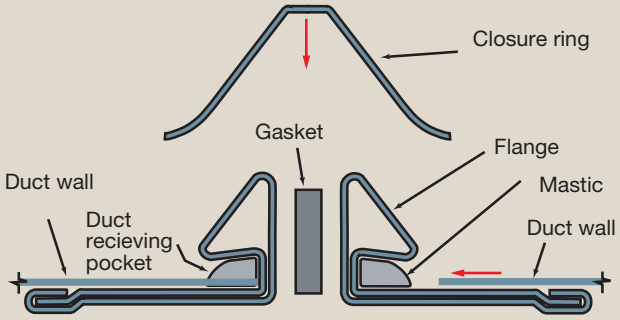
Spiralmate

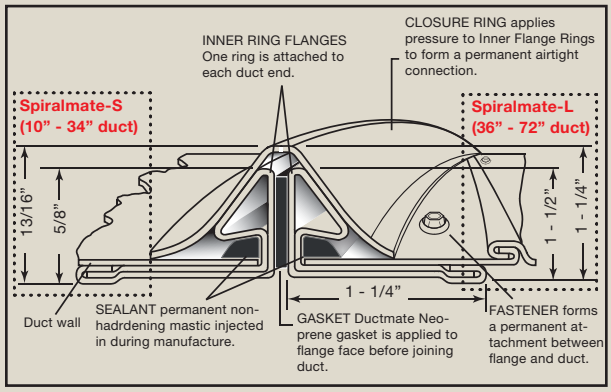
Spiralmate® flanges are airtight and easy to install, and no additional sealants are required. They can be installed on-site, they are easy to align, and they use a one-bolt closure. Spiralmate fits Spiral seam and most ribbed pipe, and it accommodates moderate variations in pipe diameter.

Spiralmate is available in diameters from 8" to 72" in 2" increments. For one-inch increments and sizes larger than 72", consult the factory.

The Spiralmate system is comprised of four components: two flanges with integral mastic injected into the duct receiving pocket, a gasket, and a closure ring and bolt. See photo on page 25.

Spiralmate® Joints





Installation Components

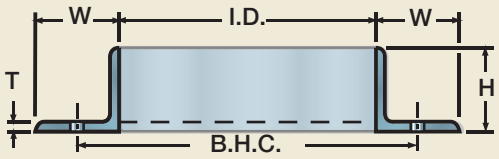
Angle Rings, Flange Clamps & Spiralmate®

	Inside Dia.	H	W	T	Bolt Hole Centers	No. of Bolt Holes	Dia. of Bolt Holes	Weight (lbs.)
PRESSED	3 1/16"	7/8"	1"	10 Ga.	4 5/16"	6	9/32"	.70
	4 1/16"	15/16"	1"	10 Ga.	5 5/16"	6	9/32"	.85
	5 1/16"	1"	1"	10 Ga.	6 5/16"	6	9/32"	1.20
ROLLED ANGLE	6 1/8"	1 1/4"	1 1/4"	10 Ga.	7 1/2"	6	3/8"	1.75
	7 1/8"	1 1/4"	1 1/4"	10 Ga.	8 1/2"	6	3/8"	2.00
	8 1/8"	1 1/4"	1 1/4"	10 Ga.	9 1/2"	8	3/8"	2.25
	9 1/8"	1 1/4"	1 1/4"	10 Ga.	10 1/2"	8	3/8"	2.50
	10 1/8"	1 1/4"	1 1/4"	10 Ga.	11 1/2"	8	3/8"	2.75
	11 1/8"	1 1/4"	1 1/4"	10 Ga.	12 1/2"	8	3/8"	3.00
	12 3/16"	1 1/2"	1 1/2"	10 Ga.	13 13/16"	12	7/16"	4.00
	13 3/16"	1 1/2"	1 1/2"	10 Ga.	14 13/16"	12	7/16"	4.25
	14 3/16"	1 1/2"	1 1/2"	10 Ga.	15 13/16"	12	7/16"	4.75
	15 3/16"	1 1/2"	1 1/2"	10 Ga.	16 13/16"	16	7/16"	5.0
	16 3/16"	1 1/2"	1 1/2"	3/16"	18 1/8"	16	7/16"	8.0
	17 3/16"	1 1/2"	1 1/2"	3/16"	19 1/8"	16	7/16"	8.25
	18 3/16"	1 1/2"	1 1/2"	3/16"	20 1/8"	16	7/16"	8.50
	20 3/16"	1 1/2"	1 1/2"	3/16"	22 1/8"	20	7/16"	9.50
	22 3/16"	1 1/2"	1 1/2"	3/16"	24 1/8"	20	7/16"	10.75
	24 3/16"	1 1/2"	1 1/2"	3/16"	26 1/8"	20	7/16"	11.50
	26 3/16"	2"	2"	3/16"	28 1/2"	24	7/16"	16.50
	28 3/16"	2"	2"	3/16"	30 1/2"	24	7/16"	18.00
	30 3/16"	2"	2"	3/16"	32 1/2"	28	7/16"	19.50
	32 3/16"	2"	2"	3/16"	34 1/2"	28	7/16"	20.00
	24 3/16"	2"	2"	3/16"	36 1/2"	32	7/16"	22.50
	36 3/16"	2"	2"	3/16"	38 1/2"	32	7/16"	23.00
	38 3/16"	2"	2"	3/16"	40 1/2"	36	7/16"	24.50
	40 3/16"	2"	2"	3/16"	42 1/2"	36	7/16"	25.75
	42 3/16"	2"	2"	3/16"	44 1/2"	40	7/16"	26.50
	44 3/16"	2"	2"	3/16"	46 1/2"	40	7/16"	28.00
	46 3/16"	2"	2"	3/16"	48 1/2"	44	7/16"	29.00
	48 3/16"	2"	2"	3/16"	50 1/2"	44	7/16"	30.75

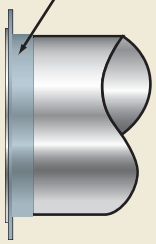
Angle Rings (Pressed or Rolled Steel)

Pressed and rolled steel angle rings are used widely in joining ductwork together in dust and fume control work. All rings are unpainted, mild steel (Galvanized and Stainless Steel available). They are available with or without holes. Dimensions shown are typical. Nearly any bolt circle or hole size is available. Consult Factory.

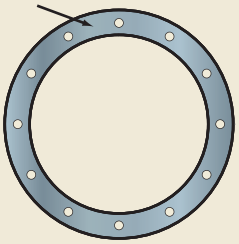
Cross Section



Side View



Face View



Spiralmate® Flange

Quick Sleeve

Flange Clamps

Spiral Manufacturing Co., Inc.
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Aviation Snips

- Made of hard Molybdenum/Silicon tool steel for good cutting edge and longer tool life
- Double-cam-action construction for 20% greater cutting power with less effort, maximum opening of jaws, minimum opening of handles
- Serrated blades - Draw work into cutting edges without slipping, for accurate, clean cuts
- Higher leverage, spring-action handles
- Hardened pivot bolt; safety latch; self-locking nuts
- Soil and wear-resistant PVC grips
- Left hand model - green - cuts right
- Right hand model - red - cuts left
- Straight - yellow - cuts straight and slight curves

Aviation Snips Ordering Information

Model No.	Description	Length	Cut
KJS1	Right hand	9–1/2”	1–1/4” 3.2 cm
KJS2	Left hand	9–1/2”	1–1/4” 3.2 cm

KJS1 – Right hand

KJS2 – Left hand

Guarantee

Every Klenk Tool carries a lifetime guarantee against breakage. Should the blades break in normal use, the tool will be replaced by the Klenk distributor, or may be returned to the factory for repair or replacement. Factory reconditioning and resharpening service is also available at a very nominal charge.

Tek-Screws and Drivers

Tek-Screws: Used as a self-drilling screw they eliminate all hole preparation. Tek-Screws can be used with or without pilot holes. Positive rake forward cutting edges drills straight thru sheet metal at peak speed. Perfectly mated threads increase strip and back out pressures. Used extensively by installers of heating and ventilating duct to produce sheet metal assemblies faster and more securely.

Tek-Screw Driver (TSD)
1/4” driver for #8 Tek-Screw

Tek-Screw
#8 x 1/2”

Available in quantities of 50, 100, 500, 1000

Sealants & Tapes

Duct Sealant & Aluminum Foil Tape

601 Duct Sealant

Premium Indoor/Outdoor Flexible Water Based Duct Sealant

A versatile, all purpose, fiber-free, duct sealant for use on all types of metal duct, glass fiber duct board, flex duct, duct fabric and flexible tubing runouts. Distinguished by its ability to accommodate minor vibration and movement, S2 - 601 stays flexible to save call-back labor. S2 - 601's excellent coverage and easy brush-on application provide low installation cost while providing proven reliability.

Specifications Compliance: Passes ASTM C-731, ASTM D-2202. USDA, EPA and FDA Approved.

321 Duct Sealant

Fiber reinforced Indoor/Outdoor Water Based Duct Sealant

S2 - 321 is an all purpose industrial grade duct sealant for all types of metal duct, glass fiber duct board, and flex duct, as well as duct fabric and flexible tubing runouts. It includes UV inhibitors for extended outdoor exposure and built-in fiber reinforcement for added strength. This non-toxic water based product is solvent free and is suitable for residential use.

Specifications Compliance: Passes ASTM D-2202, ASTM C-731. USDA, EPA and FDA Approved

Application Data for 601 and 321 Duct Sealants

Color	Gray
Application/Storage Temperature	35° F to 110° F
Service Temperature	- 20° F t0 200° F
Pressure Classes	SMACNA ½, 1, 2, 3, 4, 6 and 10 inches w.g.
Seal Classes	SMACNA A, B , C
Method	Brush, putty knife, caulk gun, pump
Rate	Apply at joint and fastener to 20 mil thick wet film after duct work installed
Clean up (wet)	Soap and water
Packaging	10 ounce tube; 1 gallon can
Coverage (1 gallon)	500 feet x 2 inches wide
Coverage (1 tube)	65 feet at 1/4" bead; 130 feet at 1/8" bead

601 & 321 Gallons

601 & 321 Tubes

1520CW Alum. Foil Tape

1402AFQ Sealant Tape

Aluminum Foil Tape

Product/ Description	Color-Size	Adhesive	Thickness/ Tensile-Strength	Peel Adhesion/ ServiceTemp.	U.L. Listed/ Flame Spread/ Smoke Devop.	Pressure Class/ Seal Class	Precautions
1520CW Dead-soft alumium foil; Silicone release liner.	Aluminum-2" x 50yds	Cold Weather Acrylic	3.5 mil 27 lbs/inch width	96 oz. per in. width -35 F to 260 F	723 Class A 5 10	None	None
1402AFG Mill finish alum. substrate with gray adhesive sealant	Aluminum or Paint-able-2" x 100ft.	100% solid elas-trometric modified butyl	2 mil Aluminum, 15 mil Gray Matter 955 psi avg.	16 lbs. per lin. Inch 35 F to 110 F	723 Class A 20 40	SMACNA 1,2,3,4 and 6 inches w.g. SMACNA A,B,C	Yes See MSDS

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Single and Double Rod Hangers, Nuts, Washers & Threaded Rods

Weights and Sizes of Single and Double Rod Hangers							
Size	**Wgt. (Lbs.)**	**Size**	**Wgt. (Lbs.)**	**Size**	**Wgt. (Lbs.)**	**Size**	**Wgt. (Lbs.)**
3”	.5	12”	1.3	24”	3.8	42”	6.4
4”	.6	13”	1.4	26”	4.1	44”	6.7
5”	.7	14”	1.4	28”	4.3	46”	6.9
6”	.7	15”	1.5	30”	4.7	48”	7.2
7”	.8	16”	1.6	32”	4.9	50”	7.5
8”	.9	17”	1.7	34”	5.2	52”	7.8
9”	1.0	18”	1.8	36”	5.5	54”	8.1
10”	1.1	20”	1.9	38”	5.8	56”	8.4
11”	1.2	22”	3.5	40”	6.1	60”	9.1
Sizes thru 20” are 1-1/2” x 16 gauge Sizes 22” and above are 2” x 14 guage							

Vertical Ducts

Maximum Diameter of Round Ducts	Straps Description
10”	0.047” (No. 18 guage) galvanized steel 2” wide
20”	0.058” (No. 16 guage) galvanized steel 2” wide*
40”	1/8” steel x 1-1/2”*
60”	1/8” steel x 2”*
Over 60”	3/16” steel x 2”*

* Spaced vertically not more than 12 ft. on centers

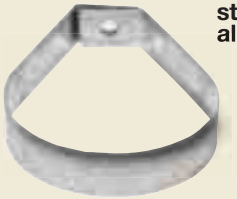
Horizontal Ducts

Maximum Diameter of Round Ducts	Straps Description
10”	Same gauge as galvanized steel duct, 1’’ wide or (No. 8 gauge galvanized steel wire) on 10’ centers
20”	Same gauge as galvanized steel duct, 1’’ wide or (No.8 gauge galvanized steel wire) tied to 1’’ galvanized steel band around duct on 10’ centers
40”	
60”	Same gauge as galvanized steel duct, 1-1/2’’ wide on 6’ centers
Over 60”	Same gauge as galvanized steel duct, 1-1/2’’ wide on 4’ centers

Reproduced from International Uniform Mechanical Code. As local codes differ, it is the responsibility of the user to determine that hangers listed will satisfy local regulations. **Spiral Manufacturing Co., Inc. assumes no responsibility other than the sizes and material listed in the Spiral Standard Hangers table above.**

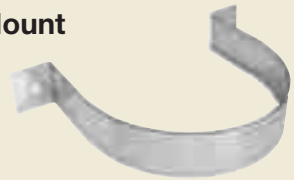
Single Rod

9/16” holes standard on all hangers



Double Rod

Wall Mount



Hardware supplied upon request.

- 10’ by 1’’ Hanger Strap, 16 guage, 25 per bundle.
- 100’ by 3/4’’ Hanger Band Rolls, 24 guage, slotted.

Hex Nut (Plated)

3/8”-16 and 1/2” - 13

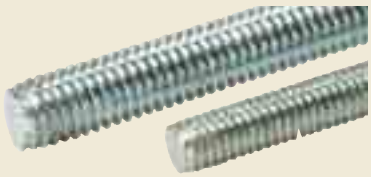
Flat Washer (Plated)

3/8” and 1/2”

Coupling (Plated)

3/8”-16 and 1/2” - 13 by 1-3/4” long

Threaded Rod



3/8”-16 and 1/2”-13
Length: 36” and 72”

Hanger Accessories

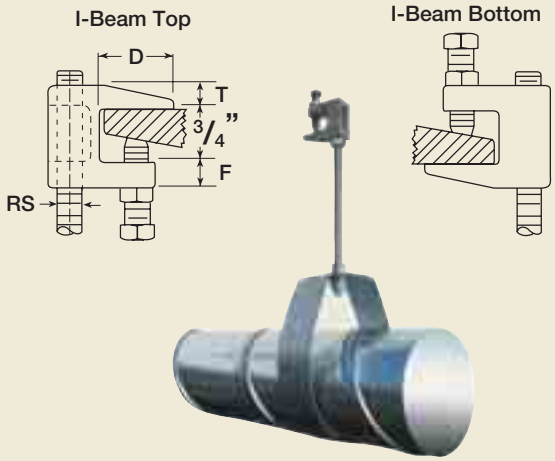
Beam clamps, struts & Speed Link®

Sammy Screws (BCW)

Sammy screws are designed to quickly fasten threaded rod to wood beams and trusses. They are available in 3/8" and 1/2" sizes.

Beam Clamp (Model 300 (BC)

Malleable iron casting with a hardened cup point set screw and locknut. UL listed. Set screw must be tightened onto the sloped side of the I-Beam, channel or angle iron flange and torque to 60 inch pounds. May be mounted in either position.



RS Rod Size	D	F	T	Max. recom. load (lbs.)	
				Top	Bottom
3/8" BC	1-1/8"	3/8"	3/8"	500	250
1/2" BC	1-1/16"	1/2"	1/2"	950	760

Strut

1-5/8" x 1-5/8" 12 Ga.
Half-Slot (HS)
1-1/8" x 9/16" slots
punched on 2" centers

Universal Support System

The **Universal Support System** is a stand-alone hanging system that supports a wide variety of applications.

This system comprises a galvanized steel aircraft cable with integral, self-locking hook and a patented locking device that allows quick installation and release for adjustment or removal.

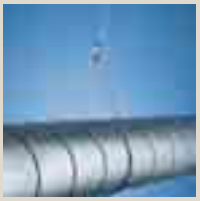
The system is available in 2mm and 3 mm cable sizes, which support 100lb. and 200 lb. loads respectively. Both have a 5-to-1 safety factor.

Installation

Thread locking device onto cable

Fasten cable to beam with beam clamp

Or wrap cable around beam



Wrap cable around duct

Thread cable back through locking device

Release cable with unlocking tool or small screwdriver

The Universal Support System is cULus® listed and has a DIN 4102-2 F30-A fire rating of 30 minutes for 2mm wire rope and an F60-A rating of 60 minutes for 3mm wire rope.

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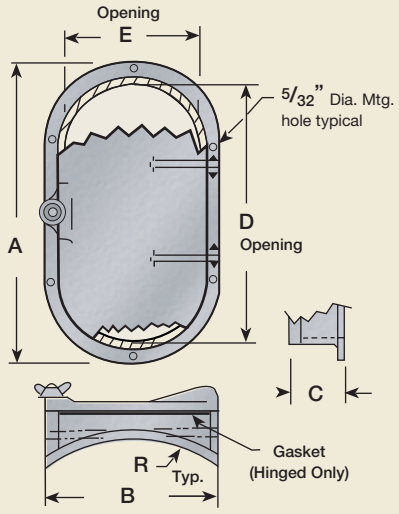
Aluminum Contoured Hinged

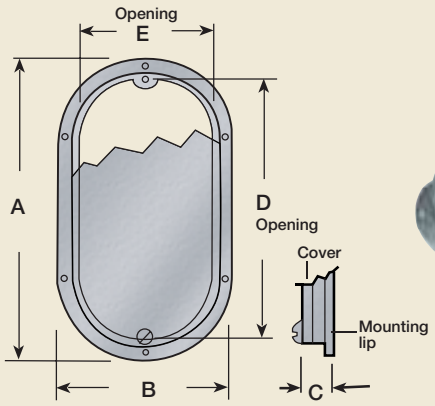


Size	A	B	C	D	E	R	Wgt. Lbs
6”	9	5 1/2	2 3/4	6 3/4	4	3	1 1/2
8”	9	5 5/8	2 1/4	6 3/4	4	4	1 3/4
10”	9	5 3/4	2 3/8	6 3/4	4	5	2
12”	11 1/8	6 3/8	2 3/8	9 1/8	4 1/2	6	2 1/2
14”	11 1/4	6 1/2	2 3/8	9 1/8	4 1/2	7	3
16”	11 1/4	6 1/2	2 1/4	9 1/8	4 1/2	8	3

Aluminum Flat Hinged

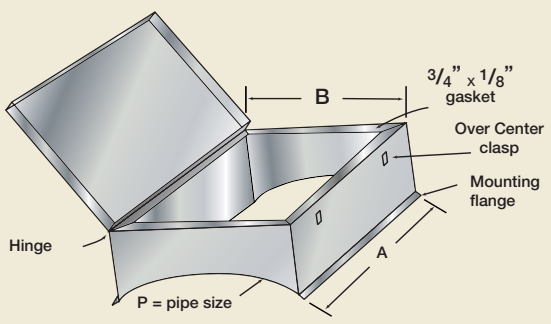
Size	A	B	C	D	E	Wgt. Lbs
4 1/2”x9”	11 3/8	6 3/4	1 5/8	9 1/4	4 3/4	2 1/2
9” x 18”	20	11 1/8	1 5/8	18	9	5
18” x 18”	21	21	1 5/8	18	18	16

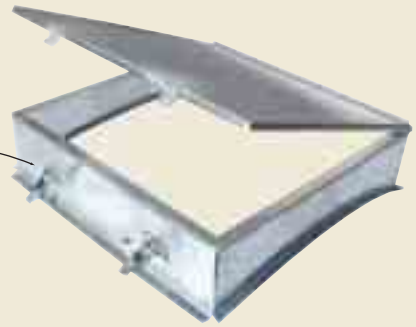
Aluminum Contoured – (removable cover)



Size	A	B	C	D	E	R	Wgt. Lbs
4”	6	3 1/2	1 7/8	3 3/4	2 3/8	2	1/2
6”	8 7/8	5 3/8	2 1/2	6	3 7/8	3	1
8”	8 7/8	5 5/8	2 1/6	6 1/4	4	4	1 1/2
10”	8 7/8	5 5/8	2	6 1/4	4	5	1 1/2
12”	8 3/4	6 1/2	1 3/4	6 1/4	4	6	1 1/2
14”	11 1/8	6 1/2	2	8 1/2	4 1/2	7	2 1/4
16”	11	6 1/2	1 3/4	8 1/2	4 1/2	8	2 1/4
18”	11	6 1/2	1 3/4	8 1/2	4 1/2	9	2 1/4
20”	11	6 1/2	1 3/4	8 1/2	4 1/2	10	2 1/2
22”	11	6 1/2	1 3/4	8 1/2	4 1/2	11	2 1/2
24”	11	6 1/2	1 3/4	8 1/2	4 1/2	12	2 1/2

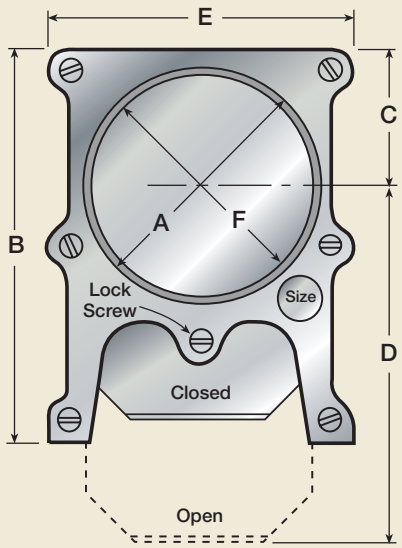
Galvanized Access Door (Contoured or Flat)





Blast Gates

Cast Aluminum Full Gates & Half-Gates

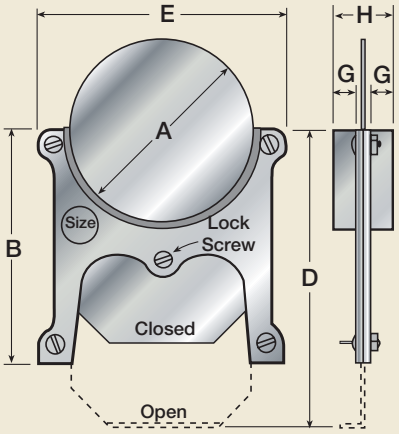


Full Gates (Cast Aluminum)

Size	A	B	C	D	E	F	G	H	Wgt. Lbs
2”	2 5/16	4 1/2	1 3/4	4 1/2	3 5/8	2	3/4	1 7/8	0.5
3”	2 13/16	5 5/8	1 11/16	5 7/8	4	2 1/2	3/4	1 7/8	1
4”	3 13/16	6 7/8	2 3/8	7 9/16	5	3 7/16	3/4	1 7/8	1
5”	4 3/4	8	3	9 1/2	6	4 1/2	7/8	2 1/8	1.5
6”	5 9/16	10	3 1/4	11 1/4	7	5 7/16	7/8	2 1/8	2
7”	6 13/16	11 1/4	3 3/4	11 7/8	8	6 7/16	1 1/16	2 1/2	2.5
8”	7 13/16	12 5/8	4 1/2	14 1/4	9 5/8	7 7/16	1 1/2	4	3.5
9”	8 15/16	13 1/2	5 3/8	16	10 1/2	8 1/2	1 7/8	3 1/2	5
10”	9 13/16	14 3/8	5 11/32	17	11 3/8	9 9/16	1 1/2	3 3/4	5.5
11”	10 3/4	15 1/4	6	19 1/2	12 1/2	10 3/8	1 7/8	3 1/2	7
12”	11 13/16	16 1/4	6 3/4	20 5/8	13 1/4	11 9/16	1 1/2	3 5/8	7
14”	13 11/16	18 15/16	7 7/32	23 1/8	15 3/4	13 7/16	1 7/8	4 3/8	13
16”	15 11/16	21 1/4	8 9/16	27	17 7/8	15 7/16	1 7/8	4 3/8	16.5
18”	17 21/32	32 9/16	10 11/16	30 9/16	20 1/8	17 7/16	3	7	30
20”	19 11/16	34	11 3/16	33 5/8	22 1/4	19 7/16	3	7 1/8	35
22”	21 27/32	34	12	35 7/16	24 1/2	21 15/32	3	7 1/8	39.5
24”	23 13/16	34	13	49 7/16	26 1/2	23 7/16	3	7 1/8	52.5

** See side view of Half-Gate for “G” and “H” Dimensions.*
Stainless steel and larger sizes available upon request.

Cast aluminum body with galvanized steel sliding door standard.



Half-Gates (Cast Aluminum)

Size	A	B	D	E	G	H	Wgt. Lbs
3”	3	4	5 3/4	4 1/2	7/8	2 1/4	.625
4”	4	4 1/2	7	5 1/2	1	2 1/2	.75
5”	5	5 3/8	8 3/4	6 1/2	1 1/8	2 1/2	1.0
6”	6	7	10 1/4	7 1/2	1	2 3/4	1.75
7”	7	7 1/2	11 3/4	8 1/2	1	2 5/8	2.25
8”	8	7 3/4	13	9 3/4	1	2 5/8	2.75
9”	9	8 1/2	16	11 1/4	1	2 5/8	3.25
10”	10	9	16 3/4	12	1 1/8	3	4.0
11”	11	9 3/4	19 1/2	13	1 1/2	3 1/2	4.75
12”	12	10	19 3/4	14	1 1/8	3	5.5
14”	14	11 1/2	25	16 1/2	2	4 1/8	8.5
16”	16	12 3/8	26 3/4	18 1/2	2	4 1/8	10.25
18”	18	23 3/8	31 1/2	21 1/8	2	4 7/8	11.0

Larger sizes available upon request.

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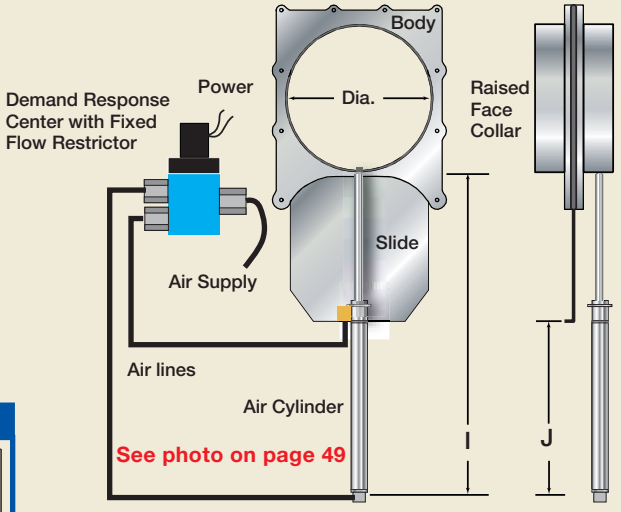
Air Gates (Cast Aluminum with Stainless Steel Cylinder)

A unique, electrically controlled, compressed air actuated blast gate. Mount them in even the remotest areas, and let them work for you. The operating slide design is encapsulated in a rigid cast aluminum frame and is powered by a patented "floating" piston/cylinder assembly designed for trouble free operation regardless of velocity pressures in the air handling system. Operates in any position and adapts to pipe or fittings from 3" to 16". Operating air pressure from 40 to 150 PSI. Factory tested and ready to install.



See photo on page 49

Table 32-1: Air Gate Electrical Data

LD5 VOLTAGE +/- 10%	CODE	CURRENT (AMPS) INRUSH	CURRENT (AMPS) HOLDING	RESISTANCE (OHMS @ 25 C)	POWER (AC=VA DC=WATTS)
		NEMA			
		4	4	4	4
22/50 24/60	DA	.15	.15	78	2.6
110/50 120/60	AA	.02	.02	2890	2.6
220/50 240/60	AB	.01	.01	9515	2.6
12VDC	DA	.15	.15	78	2.0
24VDC	DB	.09	.09	283	2.0
125VDC	AB	.01	.01	9515	2.0

Table 32-2: Air Gate Size Data

Dia.	I	J	Wgt. Lbs
3"	10.28"	7.28"	1.5
4"	12.28"	8.28"	1.75
5"	14.28"	9.28"	2.5
6"	16.28"	10.28"	3.25
7"	18.28"	11.28"	3.75
8"	20.28"	12.28"	5.25
9"	22.28"	13.28"	6.25
10"	24.28"	14.28"	7.5
11"	26.28"	15.28"	8
12"	27.28"	15.28"	9.25
14"	Call Factory		
16"			

Larger sizes available upon request.

Control Dampers

Our series 83 Volume dampers are made of 20 gauge galvanized steel, utilizing heavy guage plated steel quadrants, designed with excellent handle action as well as quick wing nut adjustment for locking the damper. The frame is marked to show the exact position of the damper. It uses a 3/8" square end bearing in conjunction with a 3/8" spring lock pin adjacent to it. Body length equals diameter plus 4"(L=D + 4).

Our series 78 Double Quadrant Damper is designed for quick installation in the field and lower air pressure. This damper utilizes two fully retractable threaded spring bearings, one washer with pointer handle, and a 5/16-18 wingnut.

Series 83

Series 78

Flexible Hose

Clear Clear Polyurethane Hose & Fittings

Flexible Clear Polyurethane Hose (LD)

Flexible clear polyurethane hose is tough and durable, and suitabe for a wide variety of appiications.

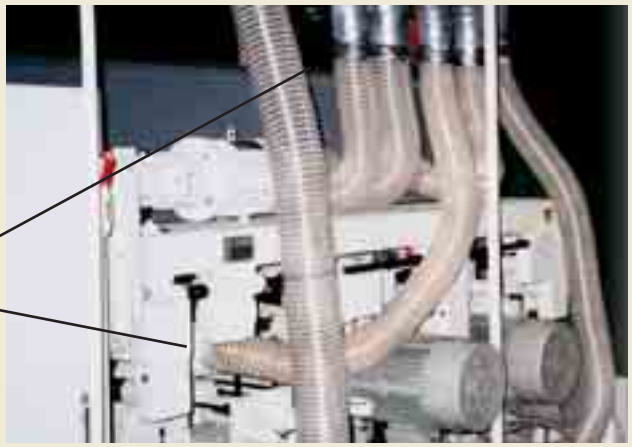
Flexible Hose Cross-Section

HD Flex Hose Disconnect

Hose Coupling

J-Lock Coupling

Warning: To reduce the risk of static discharge igniting suspended particulates, the flex hose helix wire must be grounded to both the duct system and the machine as shown above.



Typical machine application

- **Construction:** Light duty clear polyurethane wall hose construction reinforced with a spring steel wire helix.
- **Product Features:**
  - Excellent compressibility
  - Cut, gouge, and chemical resistant
  - Efficient flow characteristics
  - Designed for wide temperature ranges
  - Maximum flexibility and abrasion resistance
- **Applications:** Recommended for industrial air movement, fume control, and dust collection applications.
- **Temperature Range:** -65° F to 225° F
- **Diameter Range (Inches I.D.):** 2”-18” (Available to 24”)
- **Standard Lengths:** 10, 15, and 25 Feet
- **I.D. Tolerances (Inches):** Up to 8”: -0.00 to +0.125; 8” and over: -0.00 to +0.250 Inch
- **End Finish:** Plain Cut
- **Standard Color:** Standard LD color: clear
  Standard HD color: black

See clamps on next page.

Table 33-1: Flexible Hose Properties

Inside Dimension (inches)	Approx. Wgt. (lbs./ft.)	Minimum Centerline Bend Radius (inches)	Compression Ratio	Maximum Recommended Negative Pressure (in./Hg)	Maximum Recommended Positive Pressure (psi)
2	.19	1.4	5:1	29	30
2.5	.29	1.4	5:1	19	30
3	.3	1.8	5.5:1	29	30
4	.46	2.7	6:1	24	22
5	.56	3.4	5.5:1	13	18
6	.66	3.8	6.5:1	8	15
7	.73	4.2	6.5:1	8	10
8	.65	5.2	6.5:1	2	7
10	1.1	6	6.5:1	2	7
12	1.3	7	6.5:1	1.7	6
14	1.5	8.4	6.5:1	1.1	5
16	1.7	9.6	6.5:1	.7	4.6
18	1.9	11	6.5:1	.5	4.1

Note: Technical data based on 2 ft. straight lengths of hose @ 72° F.

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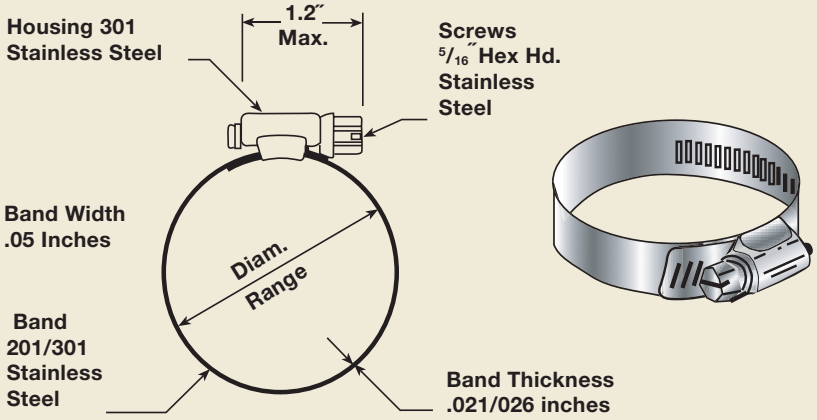
Flexible Steel Hose & Hose Clamps

Hose Clamps



For clear polyurethane and black heavy duty (HD) flexible hose only

Table 34-1:
Hose Clamp Sizes

No.	Range
02HC	$1^{13}/_{16}$ - $2^{3}/_{4}$″
03HC	$2^{9}/_{16}$ - $3^{1}/_{2}$″
04HC	$3^{1}/_{2}$ -$5^{1}/_{2}$″
05HC	$4^{1}/_{2}$ - $6^{1}/_{2}$″
06HC	$5^{3}/_{4}$ - $7^{3}/_{4}$″
07HC	$6^{1}/_{2}$ - $8^{1}/_{2}$″
08HC	2 - 10″
10HC	$9^{1}/_{2}$ - $11^{1}/_{2}$″
12HC	11 - 13″
14HC	$12^{1}/_{2}$ - $14^{1}/_{2}$″
16HC	$15^{3}/_{8}$ - $17^{3}/_{8}$″
18HC	18 - 20″

Bridge Clamps

Bridge clamps provide a tight seal on right-hand (standard) spiral wire flex hose. Band and housing are Type 301 stainless steel. Band is $^{1}/_{2}$″ wide and 0.025″ thick. Screw is Type 305 stainless.

Note: To determine the spiral direction of your hose, look at the end of the hose. If the spiral goes away from you in a clockwise direction, then the hose has a right-hand spiral.

Flexible Steel Hose

Flexible steel hose is strip-wound interlocked and made from hot-dipped galvanized carbon steel. There are two different gauge thicknesses to choose from, depending on the severity of service. It can be twisted without unraveling. Steel flex is rated to 788° F. Spiral Manufacturing suggests that operating temperature not exceed 400° F. It is sold fully extended and may be less than specified length if compressed.

Galvanized steel all metal suction and blower hose for dust and fume collection. An excellent choice for wood shop molders.

Table 34-2:
U100 .010”- .012” strip thickess

Inside Diameter (inches)	Minimum Inside Throat Radius (inches)	Approx. Weight Per Foot (lbs.)
2”	6.34	.70
3”	9.75	1.02
4”	12.00	1.38
5”	16.25	1.70
6”	19.50	2.00
7”	22.75	2.33

Table 34-3:
U120 .018”- .020” strip thickess

Inside Diameter (inches)	Minimum Inside Throat Radius (inches)	Approx. Weight Per Foot (lbs.)
8”	30.00	4.65
9”	36.00	5.22
10”	40.00	5.78
12”	48.00	6.91

From fully collapsed, tubing can be extended 2.5” per foot under a tension load of 25-lbs. minimum to 45-lbs. maximum. Install in systems in semicompressed condition, midway between fully extended and fully compressed.

Underground Duct

Advantages, Description & Installation of Underground Duct Systems

Underground Duct

PVS (Polyvinyl Steel) coated underground HVAC duct (also known as PCD, PVC coated, and PVCS) is UL® listed and specified more often by architects, engineers, and contractors than any other underground air delivery system because it offers both the strength of steel and the inertness of plastic. These attributes make PVS ideal for in underground as well as corrosive fume exhaust applications, such as in the plating industry.

How PVS is manufactured

PVS is manufactured by a three step process: 1) hot-dipped, galvanized G-60 steel is cleaned and fire treated; 2) a special epoxy primer is baked onto both sides of the sheet; 3) Finally, a 4 mil. polyvinyl chloride coating is heat fused onto one side (4 x 1) for underground HVAC or onto both sides (4 x 4) for chemical fume exhaust applications. The result is a tough, corrosion resistant surface that will not crack, chip, peel, or rust.

Advantages of underground PVS duct

- Placing ductwork underground results in a more aesthetically pleasing interior. *Acoustical* aesthetics is also improved since most or all of the "rumble" associated with interior duct is significantly reduced or eliminated.
- The space between the ceiling and roof can be reduced, making it easier to install electrical and fire suppression systems.
- Installing duct underground allows the air delivery system to be designed for optimum efficiency because ducts do not have to run through, or parallel to roof supports. In addition, runs inside interior or exterior walls can often be eliminated.
- Underground duct is a cost effective solution when air needs to be supplied to adjacent or contiguous buildings because a central unit can serve all locations.
- PVS duct requires no protection from concrete or the minerals and salts found in backfill.
- It is strong enough to walk on and will carry moderate soil loads; yet it can be cut or modified on the jobsite with circular or saber saws fitted with metal cutting blades.

Installation

Although PVS duct has been used successfully in underground applications for over 30 years, successful results depend on correct installation procedures.

Engineering Considerations:

- It is always recommended that duct systems–whether above or below grade–be designed by a qualified engineer and installed by a qualified contractor. When a concrete slab ***will not*** cover underground duct, special consideration must be given to potential future loading from heavy equipment. If such loading is expected, PVS duct can be incased in concrete, in which case the duct will need to be securely tied down to prevent "floating." When a concrete slab *will* cover the duct, loading is not as critical, but it is recommended that the duct not be buried deeper than 2.5 times its diameter. At depths greater than 2.5 times the diameter, additional measures must be taken to insure the duct does not collapse. Such measures include the use of painted angle-iron flange connectors for added stiffness at joints, special reinforcing around the duct, or (on ducts 36" or larger) internal reinforcement. *Consult a qualified engineer when such measures are required or when there is any concern about loading.*

Preparing the sub grade:

- PVS duct can be placed directly on the soil with no special precautions to protect the duct. However, drainage needs to be considered because standing water may eventually find its way into the duct causing mold and odor problems. The grade should always be sloped back to the utility room, and ***never*** *place PVS duct at or below the water table*.
- It is recommeded that the duct be placed on 2" to 6" of pea gravel or other material that will permit easy drainage, especially when soil conditions are marginal. (Although not required to protect the duct, a vapor barrier should be placed under the duct and below the entire slab to prevent moisture from percolating through the concrete.)

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Connecting, Fastening & Backfilling

Connecting and fastening:

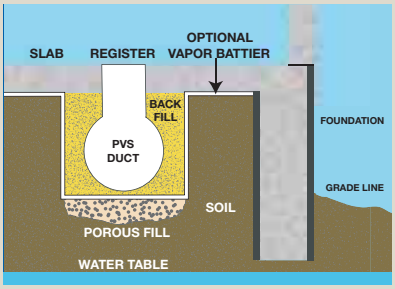
PVS Duct and fittings (or connectors) have male and female ends, respectively, and they are designed to slip together. Before joining, PVC sealant must be applied to the outside of the female fitting (or connector) and the inside of the duct. The joint must then be fastened around its circumference with sheet metal screws spaced no more than 6" apart and with a minimum of three screws per joint. Sealant should then be applied to the joint's edge and to screw heads. After the sealant has cured, the joint should be wrapped with two to three layers of PVC tape.

Spot surface repair:

The plastic surface of PVS duct is exceptionally tough, but it can be scratched. When scratches expose bare metal, they should be sealed with PVC tape or PVC Touch-Up Paint spray. Having these remedies available at the jobsite helps to assure that this detail is not neglected.

Backfilling:

After the duct has been placed, spread backfill evenly in several layers (depending on the diameter of the pipe) and tamp each layer. Tamping should be done carefully to avoid denting or scratching the pipe's surface; do not use mechanical tampers since their shockwaves can severly damage the duct. Do not toss backfill directly on the duct since this may cause denting, scratching, or even collapse if a large weight of fill is dumped directly onto the pipe. Similar care should be taken if concrete is being used to encase the duct.



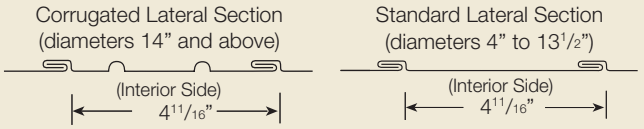
The duct, encased either in concrete or buried directly below a concrete slab, is installed above the original line of undisturbed soil and above the water table. Encasing the duct in concrete with porous fill beneath is the best way to install PVS duct. An optional vapor barrier can be placed between the pipe and the fill. Always consult local building codes for specific installation instructions.

Table 36-1: Load Specifications

Diameter (inches)	Max. Loading (lbs./linear ft.)
8" or less*	400
9" to 13–1/2"*	600
14" to 36"**	1800

*Uncorrugated **Corrugated

All ducts 14" or larger are corrugated for underground applications. Loading specifications for ducts larger than 36" have not been determined.



Precautions and limits:

Sheet metal duct is flexible, not rigid, so greater care must be taken when installing PVS duct. Three parameters need to be considered: External load (soil load = point load), soil stiffness (modulus), and pipe stiffness. In the absence of test data, a soil modulus of 200 PSI and a soil density of 120 lbs/ft^3 can be used in calculations. Consult with an engineer. ***PVS Temperature Limits:*** Operating temperatures for PVS range from -40° F to 250° F, with limited exposure to 400° F.

Spiral Manufacturing Co., Inc. offers a broad line of Class 1 PVS Spiral pipe and fittings. We build custom made fittings and hoods on request to accompany our standard product line. Our PVS products comply with the following codes and industry standards:

UL 181 Class 1
International Mechanical Code 1996 Section 603
ICBO Uniform Mechanical Code - (UMC) 1997
SMACNA Sheet Metal Air Conditioning Contractors National Association

Low Pressure

A complete line of low pressure duct & fittings — in stock and available

The terms “low” pressure and “high” pressure in duct design and selection have, unfortunately, been given a rather wide latitude of meanings in the HVAC industry over the years. The terms have been applied to “pressure” and “velocity” simultaneously because they are inter-dependant in ductwork design. This section of the catalog is devoted to the definition and selection of “low” pressure equipment and components.

The dividing line for “velocity” of air in ducts has been defined in various applications as anywhere from 1500 to 2500 fpm and nominally as 2000 fpm. Empirical data has shown that duct sections operate satisfactorily over the above range of velocities at 1˝ water gage (˝wg).

Low pressure systems are chosen where duct space allows, where air noise is a consideration, and where particle conveyance such as wood chips or grain is not a requirement.

Space limitations in modern buildings have restricted the size of air conditioning ducts and equipment. Therefore, to convey the necessary volumes of air, higher velocities must be employed. Increased velocities produce higher duct friction losses. In order to maintain flow against the higher duct friction, it is necessary to have greater pressures at the air source. Therefore, the terms “high pressure” and “high velocity” generally go hand in hand. Conversely, this is true of “low pressure” and “low velocity”.

The use of the terms “high velocity” and “high and medium pressure” in this catalog refer to any static pressure class of 3˝ wg or greater, and “low pressure” refers to 2˝ wg or less.

SMACNA recommendations on pressure and velocity are shown in Table 37-1. The listed classifications pertain to ducts only. Casing and plenum construction designs are provided in the SMACNA “Low Pressure” manual and in the “High Pressure” manual, but their respective designs have been based on historical acceptability.

Table 37-1: Pressure Velocity Classification [1]

Former Duct Class	Pressure Rating	Pressure	Seal Class[2]	Velocity (fpm)[3]
High Pres.	10”	Pos.	A	2000 Up
Medium Pres.	6”	Pos.	A	2000 Up
Medium Pres.	4”	Pos.	A	2000 Up
Medium Pres.	3”	Pos. or Neg.	A	4000 Dn
Low Pres.	2”	Pos. or Neg.		2000 Dn
Low Pres.	1”	Pos. or Neg.		2000 Dn
Low Pres.	½”	Pos. or Neg.		1500 Dn

[1] Reproduced in part by Permission From SMACNA High Pressure Duct Standards - 3rd Ed.

[2] Seal Class A: All seams, joints, fastener penetrations and connections sealed.

[3] General velocity level through this pressure rated section of the system. Certain points may have higher or lower velocities, e.g., fan outlet or restricted passage, yet not require a different pressure class. The designer makes determinations of duct class after analyzing velocities and operating pressures.

Spiral Manufacturing stocks a complete line of low pressure fittings and installation accessories.

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Low Pressure

A complete line of low pressure duct & fittings. Custom fittings available

Adjustable Elbows

Concentric Reducer

Shoe Tap

90° Angle Boot (PVS)

Loop Head Saddle (PVS)

Register End Boot (PVS)

*Conical Takeoff **

Air Intake Hood

Canvas Connections

*Airflow Takeoff (HET) **

45° Register Saddle (PVS)

Starting Collar with damper

* Preinstalled Peel n' Stick gasket. Available with or without damper.

Dust Collection

The importance of dust collection & choosing the right type of duct for dust collection

Why you need a dust collection system

Installing an efficient dust collection system should be a priority for the small shop as well as the large shop, whether the material being machined is wood, plastic, or a composite. Not only is this essential for health reasons and compliance with many national and local codes, but it is also good business because it saves money and helps to maintain the quality of the finished product.

The harmful health effects of inhaled particulates (many of which are carcinogens) are well documented, and skin, eye, and nose problems as well as allergic reactions are frequently reported. In addition, a dusty shop increases the risk of worker injury and fire, which can result in lost production, higher insurance rates, and lawsuits.

A dusty shop compromises the quality of the finished product: Accurate measurements and cuts are more difficult due to lack of visibility; airborne dust finds its way into finishing areas causing defects in the final product; and larger particles cling to surfaces cause scoring and other defects.

Finally, dust that is not automatically collected must be collected manually as a recurring direct labor expense.

By any measure, an efficient dust collection system is an investment that more than pays for itself.

Designing a dust collection system

In the simplest terms, a dust collection system is comprised of a ducting system to transport the dust from the source (table saw, planer, etc.) and a collection device (such as a bag and filter system or a cyclone), which pulls the dust through the ducting and collects it. The very first decision you must make is whether your ducting will be metal or plastic—and here there is only one logical choice: metal. (See "Metal vs. Plastic Duct" below.) The next step is to size your system. (See "Designing Your System" on pages 41-44.)

Metal vs. Plastic Duct

Plastic pipe (or PVC pipe) is unsuitable for dust collection for three reasons:

- First, plastic pipe fittings are not offered in the diversity required to meet design requirements.
- Second, plastic pipe elbows have a short radius, which encourages clogs and compromises system efficiency.
- Third, and most important, plastic pipe is non-conductive and builds up a static charge as charged particles pass through it. This static charge can discharge at any time causing shock and surprise, which is dangerous around running machinery. More serious is the risk of explosion and fire. Fine dust particles suspended in air have significant explosion potential—all that is needed is a spark, which the static charge on plastic pipe conveniently supplies. Grounding plastic pipe requires wrapping it in wire both inside and out—an expensive (and never certain) proposition that negates the minimal price savings in going to plastic in the first place.

Spiral steel pipe has none of these disadvantages. An incredible variety of fittings are available and custom fittings can be easily fabricated. The fittings are designed with long radius to minimize clogging, and special fittings such as clean-outs and quick disconnects are available. Most important, Spiral metal pipe is conductive, and simple and easy to ground, even when flexible rubber hose is used to connect the duct to the machine.

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Standard dust collection components & accessories

Spiral Manufacturing has all the duct components you need to design and build a safe and efficient dust collection system

Laterals *(Pages 12-14)*

Reducers *(Page 15)*

Elbows *(Pages 5-6)*

Blast Gates *(Pages 31-32)*

Clean-outs *(Page 30)*

Floor Sweeps *(Page 17)*

Clear Flex Hose *(Page 33)*

Manifolds *(Page 14)*

Custom Hoods *(Page19)*

Clamps *(Page 34)*

Bellmouth *(Page 17)*

Duct Sealants *(Page 27)*

Dust Collection

How to design an efficient dust collection system with Spiral pipe.

Designing Your System

There are two phases to designing your dust collection system: The first phase is sizing your duct work for adequate volume and velocity of flow for the type of dust you will be creating; and the second phase is computing the *static pressure* (SP) of your system to determine the size and power of your dust collection unit.

Prior to making your calculations, diagram the floor plan of your shop to scale on graph paper. Include the size and location of each machine, and the location of its dust port or outlet; the floor to joist dimension; the location of the dust collecting unit; and the most efficient (fewest number of turns or bends) path for routing your duct lines. This is also a good time to start your take-off list of duct components for your system.

You will also need to familiarize yourself with the following concepts:

CFM (Cubic Feet per Minute) is the volume of air moved per minute.
FPM (Feet per Minute) is the velocity of the airstream.
SP (Static Pressure) is defined as the pressure in the duct that tends to burst or collapse the duct and is expressed in inches of water gage (˝wg).
VP (Velocity Pressure), expressed in inches of water gage (˝wg), is the pressure in the direction of flow required to move air at rest to a given velocity.

CFM is related to FPM by the formula CFM = FPM x cross-sectional area (ft^2). FPM is important because a minimum FPM is required to keep particles entrained in the air stream. Below this minmum FPM, particles will begin to settle out of the air stream, forming clogs—especially in vertical runs. Table 41-1 shows the minimum FPM that Spiral Manufacturing recommends for several types of dust in branch and main runs.

Step 1

From the Table 41-1 determine the velocity (FPM) of your system for the type of dust that will be produced. For the purpose of the following examples assume woodworking dust. Wood dust requires 4500 FPM in branches and 4000 FPM in mains.

Table 41-1: Velocity for Type of Dust

Type of Dust	Velocity in Branches (FPM)	Velocity in Main (FPM)
Metalworking Dust	5000	4500
Woodworking Dust	4500	4000
Plastic/Other Light Dust	4500	4000

Step 2

Determine the diameter of each branch line. You can use the diameter of a factory installed collar or port, or consult the manufacturer. Convert metric ports to the nearest inch. Convert rectangular ports to the equivalent round diameter. Ports less than 3” will require a reducer to 4”. Record any reducers or rectangular to round transitions on your take off list.

Step 3

Using Table 41-2, determine the CFM requirement of each branch. Remember the FPM for wood dust in branch lines is 4500.

Example: Table saw 4” dia. 390 CFM (rounded)
Planer 5” dia. 610 CFM (rounded)
Lathe 6” dia. 880 CFM (rounded)
Continue for all branches.

Table 41-2: CFM for for pipe diameter at specified velocity

Diameter	3500 FPM	4000 FPM	4500 FPM
3”	277	316	356
4”	305	348	392
5”	477	546	614
6”	686	784	882
7”	935	1068	1202
8”	1222	1396	1570
9”	1546	1767	1988
10”	1909	2182	2455
12”	2749	3142	3534
14”	3742	4276	4810

For larger diameters see pages 59-60.

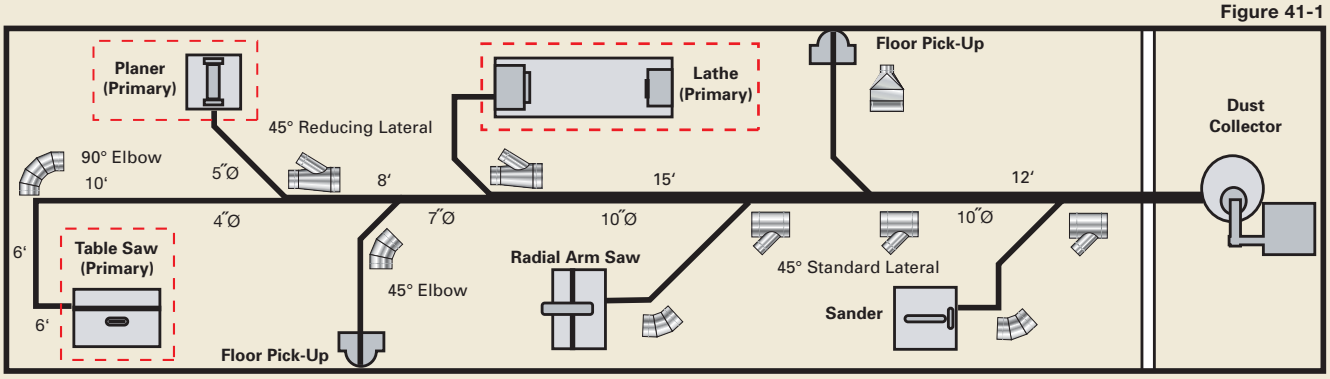
Step 4

Identify your primary or high-use machines. These are the machines that operate simultaneously on a frequent basis. The objective here is to define your heaviest use scenario so you can size your system to meet it. Including infrequently used machines and floor pick-ups in your calculations will only result in an over-designed system that will cost more to purchase and to operate. At this point, all of your branch lines are sized, and you have a list of all components required for your branch lines.

Step 5

Now you are ready to size the main trunk line. Begin with the primary machine that is *furthest* from where you will place the dust

Figure 41-1



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collecting unit. In our example, this is the table saw, which has a branch diameter of 4". Run this 4˝ Spiral pipe to the point where the second primary machine (the planer on a 5˝ branch) will enter the main. (Note: If a non-primary machine or pick-up is added to the system between primary machines, the size of the run is not increased.)

You now have a 390 CFM line (table saw) and a 610 CFM line (planer) combining for a total of 1000 CFM. Using Table 41-2 again, you will see that for 4000 FPM (the velocity requirement for main line that you determined in Step 1) the required pipe diameter falls between 6" and 7". (Note: Spiral Manufacturung recommends that you round up to 7". This not only assures adequate air flow but also anticipates a future upgrade in machine size.)

Now calculate for the addition of the third primary machine (the lathe on a 6˝ branch). You have an 1000 CFM main + an 880 CFM branch line (for the lathe) for a total of 1880 CFM. Using Table 41-2 once again, 1880 CFM at 4000 FPM requires between a 9" and 10" pipe. We recommed rounding up to a 10" main after the addition of the lathe. The main going to your dust collecting unit will be 10", and your dust collection unit must be capable of pulling 1880 CFM through a 10" duct at 4000 FPM.

Step 6

In this step, you calculate the Static Pressure (SP) or the resistance of your system that your dust collection unit must overcome. Static Pressure is measured in inches of water gage (˝wg). To do this you total the Static Pressures of the following system component groups**:**

1) The branch line with the greatest SP or resistance (see Figure 42-1). Calculate the SP of all branchs to determine which has the greatest SP. Only the branch with the greatest SP or resistance is added to the total.
2) The SP of the main run (see Figure 42-2).
3) The SP for the collection unit's filter, if any, and for the pre-separator, if any (see Figure 42-3).
(You can use the charts on pages 51-60 to assist in your calculations.)

Figure 42-1

1) Calculate the SP of the branch with the greatest SP:
(4 feet of flex hose and one 90° elbow not shown)

Starting at the machine and working toward the main, determine the SP of each branch line component, and then total them. In our example, the branch with the greatest loss is the table saw branch, and it calculates out as follows using an FPM of 4500 for branch lines:

	SP (˝wg)
Entry loss at machine adaptor collar is 1.5 SP (a constant)	= 1.5
Four feet of 4˝ flex-hose*: Chart 57-1 shows 4˝ flex-hose (at 390 CFM) = .8 SP ÷ 100 x 4 x 27.7 = .886 SP (˝wg)	= 0.886
Three 4˝ 90° elbows: Chart 51-1 shows one elbow = .28 SP loss (˝wg) x 3	= 0.84
Three branch runs of 4˝ pipe (6+6+10) = 22': Table 55-2 shows 8.8 ÷ 100 x 22'	= 1.94
Total SP loss (˝wg) for the table saw branch equals:	**5.17**

Figure 42-2

2) Calculate the SP of the main:

In our example the main has one 8' run of 7" Spiral pipe, two runs (15' and 12') of 10" Spiral pipe connecting the main to the dust collector. In addition, there are 5 lateral reducers in the main. Our calculations for 4000 FPM in the main are as follows:

	SP (˝wg)
Eight feet of 7˝ Spiral pipe: Table 55-2 shows 3.55 ÷ 100 x 8	= 0.28
Twenty-seven feet (15 + 12) of 10˝ pipe: Table 55-2 shows 2.30 ÷ 100 x 27	= 0.62
Total SP loss (˝wg) for the main run:	**.90**

Figure 42-3

3) Calculate the SP for the collection units filter and seperator:

For these calculations, consult with the manufacturer of the collection units you are considering. For this example, we will assume that there is no pre-separator an that the SP for the filter is 1.5.

Total SP for filter:	1.50

Summing the SP loss for the system, we have:

1) Highest loss branch:	5.17
2) Loss for main:	.90
3) Filter loss:	1.50
Total SP loss (˝wg) loss in the system):	**7.57**

You now have the information you need to specify your dust collector. ***Your dust collection unit must provide a mimimum of 1880 CFM through a 10" duct at 4000 FPM, and have a static pressure capability of no less than 7.57 (˝wg).***

Additional Considerations and Recommendations:

The above example is for a small system with few variables. It is recommended that for larger systems a professional engineer be consulted to assure that the system is properly designed and sized.

If the dust collector is located in a seperate enclosure, it is essential to provide a source of make-up air to the shop to prevent a down draft through the flue of the heating system. If this is not done, carbon monoxide poisoning could result. If a return duct is necessary from the dust collector, it should be sized two inches larger than the main duct entrance and its SP loss added into your calcualtions.

Some dust collection units may not include fan curve information that shows CFM or Static Pressure variables. We do not recommend procuring collector equipment without this information.

Blast gates should be installed on all branch lines to maintain system balance.

Dust suspended in air has a potential for explosion, so it is recommended that you ground all of your duct runs, including flex-hose.

If your system has areas where long slivers of material could possibly hang-up and cause a clog, install a clean-out near that area.

Many types of dust, including many woods are toxic, so take special care to choose a filtering system that will provide optimal safety.

*** Flex-hose should be wire wrapped helix hose to permit grounding. See photo on page 33.**

Dust Collection

Exhaust Volumes & Conveying Velocities for a Variety of Production Machines

This list of recommended exhaust volumes and pipe sizes for average sized metal working and woodworking machines is based on many years of experience and the work of many people. Some modern high speed or extra large machines will require higher velocities than shown. Smaller machines may use less air than shown. The air volume required to capture the dust at the machine will vary with each operation. Particle size and hood type must be considered. The following charts will provide an excellent guide to determine your total air volume requirements.

Caution: One of the most important factors in an efficient dust collection system is proper hood design. Hoods must be designed so that the dispersed particles are thrown or deflected directly into the hood opening. The large heavy particles thrown out by the cutting heads or wheels have such a high speed that their trajectories cannot be altered by a vacuum system regardless of its velocity. In addition hoods should be placed as close to the source of dust contamination as possible since the effectiveness of an exhaust hood decreases very rapidly as it is moved away from the source. The following recommended pipe sizes are based on the use of reasonably good hoods.

Wide belt and abrasive sanders, moulders and shapers with high R.P.M. spindles often call for higher duct velocity (through hoods supplied by manufacturers) than those indicated on the charts. In these cases caution must be used.

The following charts are recommended for machines with good hood enclosures. (Also check with the machine manufacturer for their recommended velocities.)

Table 43-1: Recommended Conveying Velocities for Various Production Machines

Gang Rip Saws

Recommended Velocity 4,200 to 5,000 F.P.M.

Total Blade Dia. (in.)	Exhaust Volumes and Pipe Diameters at 4500 ft. Velocity			
	CFM	Dia.	CFM	Dia.
Up to 24'' incl.	610	5"	390	4"
25'' to 36 incl.	880	6"	610	5"
36'' to 48'' incl.	1200	7"	610	5"
Over 48'' incl.	1570	8"	880	6"

Disc Sander

Recommended Velocity 4,200 to 5,000 F.P.M.

Disc Dia. (in.)	Exhaust Volumes and Pipe Diameters at 4500 ft. Velocity	
	CFM	Dia.
Up to 12"	390	4"
13'' to 18''	610	5"
19'' to 32''	880	6"
33'' to 38''	1200	7"
39'' to 48''	1570	8"

Floor Sweep

Recommended Velocity 4,200 to 5,000 F.P.M.

Size	Exhaust Volumes and Pipe Diameters at 4500 ft. Velocity	
	CFM	Dia.
5"	610	5"
6"	880	6"
7"	1200	7"

Floor Sweeps are not added to the total load of the exhauster as they are in operation only a few minutes at a time.

(Mouth of floor sweep 10'' x 4'' to 12'' x 4" approx.)

Single Surfacer

Recommended Velocity 4,200 to 5,000 F.P.M.

Knife Width (in.)	Exhaust Volumes and Pipe Diameters at 4500 ft. Velocity	
	CFM	Dia.
Up to 6'' wide	390	4"
7'' to 12'' wide	610	5"
13'' to 20'' wide	880	6"
21" to 26" wide	1570	8"
27'' to 36'' wide	1985	9"
Over 36'' wide	2450	10"

Jointer

Recommended Velocity 4,200 to 5,000 F.P.M.

Knife Width (in.)	Exhaust Volumes and Pipe Diameters at 4500 ft. Velocity	
	CFM	Dia.
Up to 6"	390	4"
7'' to 8''	610	5"
8'' to 18''	880	6"

Turning Lathes

Recommended Velocity 4,200 to 5,000 F.P.M.

Turning Length (in.)	Exhaust Volumes and Pipe Diameters at 4500 ft. Velocity	
	CFM	Dia.
Up to 12"	880	6"
13'' to 24''	1570	8"
25'' to 36''	1985	9"
37'' to 48''	2450	10"

Horizontal Belt Sander

Recommended Velocity 4,200 to 5,000 F.P.M.

Belt Width (in.)	Exhaust Volumes and Pipe Diameters at 4500 ft. Velocity			
	CFM	Dia.	CFM	Dia.
Up to 6"	880	6"	610	5"
7'' to 9''	1200	7"	880	6"
10'' to 14''	1985	9"	1200	7"
Over 14"	2450	10"	1200	7"

Circular Saw

Recommended Velocity 4,200 to 5,000 F.P.M.

Blade Dia. (in.)	Exhaust Volumes and Pipe Diameters at 4500 ft. Velocity	
	CFM	Dia.
Up to 10"	390	4"
12'' to 14''	610	5"
16'' to 20''	880	6"
24'' to 30''	1570	8"
Variety Saws with Dado Heads	1200	7"

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Exhaust Volumes & Conveying Velocities for Dust Producing Equipment

Table 44-1: Usual Exhaust Volumes and Conveying Velocities for Dust Producing Equipment

Dust producing equipment	Exhaust hood	Exhaust requirements	Conveying velocities in FPM
Abrasive blast rooms (sand, grit or shot)	Tight enclosure with air inlets (usually in roof)	60 - 100 fpm downdraft (long rooms of tunnel proportions 100 fpm cross-draft)	4,000
Abrasive blast cabinets	Tight enclosure with access openings	20 air changes per minute but not less than 500 fpm through all openings. Openings to be baffled	4,000
Bag tube packer	Booth or enclosure (provide spillage hopper)	500 cfm/filling tube; 500 cfm at feed hopper; 950 cfm at spill hopper	4,000
Barrels (for filling or removing material)	Local hood 180 deg. around top of barrel	100 cfm/sq. ft. barrel top min.	4,000
Belt conveyors	Hoods at transfer point	Belt speeds less than 200 fpm - 350 cfm per foot of belt width, but not less than 150 fpm through open area. Belt speeds over 200 fpm - 500 cfm per foot of belt width but not less than 200 fpm through open area	4,000
Shakeout conveyor	Continuous hood with take-off max. of 30 ft. apart	350 cfm per ft. of belt width with air inlets every 30 ft.	4,000
Belt wiper (may required with high speed belts)	Tight fitting hood held against under side of belt	200 cfm per foot of belt width. Not recommended for wet belts as in ore conveying	4,500
Bins (closed bin top)	Connect to bin top away from feed point	200 fpm through open area at feed points, but not less than 0.5 cfm per cu. ft. of bin capacity	4,000
Bucket elevators	Tight casing required	150-200 fpm at all openings.	4,000
Ceramics Dry Pan Dry Press	Enclosure Local	200 fpm through all openings 500 fpm Automatic feed, 1-5 in. dia. branch at die. Manual feed, 1-5 in. dia. branch at die. 500 cfm	4,000 4,000
Vibrating feeders-shakeout hopper to conveyor	Complete enclosure	200 cfm per sq. ft. of opening (Provide rubber or canvas flexible seals between shake-out hopper sides and end and also feeder sides and end)	4,000
Floor grate	Side hood	For heavy loads of dry dust and continuous dumping or feeding operations, treat same as shake-out side hoods, see below	4,000
	Downdraft	When used occasionally, 200-250 cfm per sq. ft. of grate area - depending on fineness and dryness of material	4,000
Grinder Swing frame	Booth	100-150 fpm indraft through opening in booth face for large opening. Never below 100 fpm. Small opening with grinder in front use 200 fpm	3,500
Grinders Portable and flexible shaft	Downdraft grilles Use side shields where possible	Bench type, 150-250 cfm per sq. ft. of exhaust grille but not less than 150 cfm per sq. ft. of plan working area Floor grille, 200-400 cfm per sq. ft. of exhaust grille but not less than 100 cfm per sq. ft. of plan working area	4,000
Mixer	Enclosure	150 minimum fpm through working and inspection openings	4,000
Shake-outs Foundry	Enclosure	200 fpm through all openings in enclosure, but not less than 200 cfm per sq. ft. of grate area	4,000
Apron conveyor for light flask work	None	Ventilate conveyor equivalent to 75 to 100 cfm per sq. ft. of gross grate area, assuming all grates open at any one time	4,000
Belt conveyor for light flast non-ferrous castings	None	Same as above	4,000
Shaker conveyor above floor-snap flask work	Side or overhead hood	Ventilate housing at rate of 125 to 150 cfm per sq. ft. gross open area. Assume all doors open at one time. Include area between housing and conveyor sides in volume determination. Usual clearance 1 in. or less on each conveyor side	4,000
Tunnel ventilation	Enclosure	When vibrating shake-out hoppers are located in a closed tunnel, ventilate the tunnel at 100 cfm per sq. ft. of tunnel cross section. Exhaust from transfer points can provide all, or part of, air required. Any additional exhaust required should be taken in rear of shake-out hopper	4,000
Screens Vibrating flat deck	Enclosure	200 fmp indraft through hood openings, but not less than 50 cfm per sq. ft. of screen area	4,000
Cylindrical	Enclosure	100 cfm per sq. ft. of circular cross-section but not less than 400 fpm indraft through openings in enclosure	4,000
Miscellaneous, Packaging, machines, granulators, enclosed dust producing units. Packaging, weighing, container filling inspection	Complete enclosure Booth Downdraft	100-400 fpm indraft through inspection or working openings, but not less than 25 cfm per sq. ft. of enclosed plan area 50-150 cfm per sq. ft. of open face area 95-150 cfm per sq. ft. of dust producing plan area	4,000 4,000 4,000

Materials Transfer

Types of pneumatic conveying & design considerations

Pneumatic Conveying

Pneumatic conveying has been used to transfer bulk solids for well over 100 years. Common applications include loading and unloading of trucks, rail cars, and barges; transferring materials to and from storage silos; and transferring of materials to production machinery within manufacturing plants. In fact, pneumatic conveying of bulk materials is used more widely in industry today than any other conveying method.

Transporting bulk materials by mechanical methods such as belt, screw, drag, bucket, and other conveyors not only presents difficult problems in system design and routing, but also presents problems of environmental contamination and contamination of the material being conveyed. Pneumatic systems are, by comparison, much easier to design: it is easier to route the high pressure Spiral pipe that is used in these systems, and a broad range of fittings and specialized components, such as diverters and blast gates, are readily available to control the flow of materials. Cross contamination between the environment and the conveyed material is also eliminated since pneumatic systems are closed. In addition, pneumatic conveying can achieve relatively high transfer rates (up to or exceeding 300 tons per hour), and the range of materials that can be transferred pneumatically is nearly unlimited.

Dilute Phase Pneumatic Conveying

There are two primary methods of pneumatic conveyance: “dilute phase” and “dense phase.” In dilute phase, relatively high volumes of air moving at high speeds are used to transfer materials entrained in the air (or other gas) stream. In dense phase, low volumes of air at high pressures are used to transfer nearly solid masses of materials. Dilute phase systems can be further divided into “pull” systems that operate below atmospheric pressure, “push” systems that operate above atmospheric pressure, and hybrid “push-pull“ systems, which are frequently used when materials need to be unloaded and then conveyed over long distances.

Design considerations

The design of dilute phase pneumatic transfer systems (whether push or pull) requires careful consideration of a number of important considerations:

- Material considerations include particle attributes such as particle size and size distribution; particle shape, density, hardness and friability; physical properties such as density, compressibility, permeability, and cohesion; and other properties such as toxicity, reactivity, and electrostatic effects.
- System attributes include the resistance of pipe and fittings to chemical reactivity and abrasion, the efficient design or routing of the system to transfer materials from and to multiple points, and the maintenance of adequate airflow over the range of conditions expected.

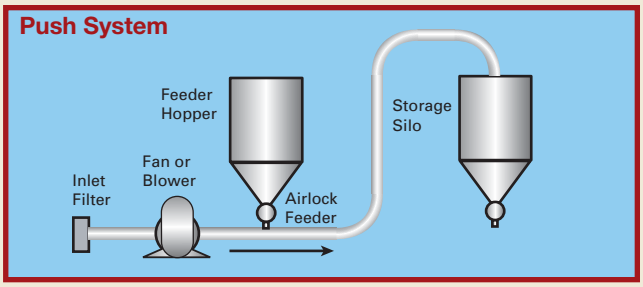
These considerations can be complex and it is recommended that you consult with a qualified and experienced sales engineer to assure that your system is properly designed.

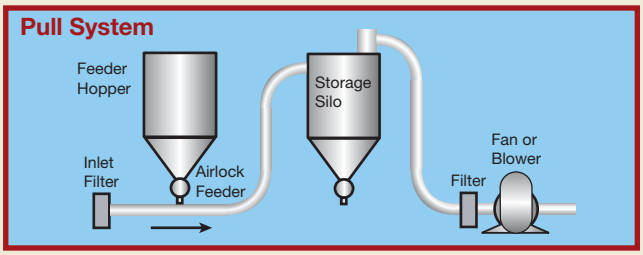
Spiral pipe is specified for dilute phase pneumatic transfer systems due to its strength, durability, and abrasion resistance, **Spiral Manufacturing** offers Spiral pipe in a variety of sizes, gauges, and materials to meet your requirements as, well as a complete line of fittings and specialized components. We can also build custom components to meet your specific requirements.

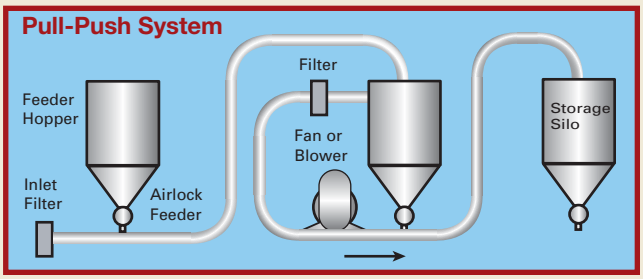
Trailer Loading

Trailer loading (see next page) is a common application of dilute phase pneumatic conveying. The following example illustrates a basic method to calculate system requirements. Before reading the example, aquaint yourself with the following terms and definitions:

Material Conveying:







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Bulk materials conveying calculations

Bulk materials, such as those shown in Table 47-1, can be conveyed pneumatically using a Radial Blade or Material Transfer Blower. ***You can calculate your system's fan or blower requirements by following the steps in Figure 48-1.*** In the following example, we will assume a requirement to convey 2,400 lbs/hr of "Wood Shavings, Heavy" through 200' of horizontal straight pipe. The steps in this example correspond to the steps in Figure 48-1.

Terms and Definitions

System: **The path through which air is pushed or pulled. This normally includes ducts, coils, filter, plenum changer, etc., through which air flows. A system can be as simple as inducing air motion into space or a network of ducts providing air for multiple locations.**

Standard Air is air which weighs .075 pounds per cubic foot, which is dry air at 70°F dry bulb with a barometric pressure of 29.92 inches of mercury.

BHP (Brake Horsepower) is the horsepower absorbed by the fan.

CFM (Cubic Feet per Minute) is the volume of air moved per minute.

Capture Velocity is the air velocity at any point in front of a hood or at the hood opening necessary to overcome opposing air currents and capture the contaminated air by causing it to flow into the hood.

Conveying Velocity is the minimum air velocity required to move or transport particles within a duct system. Measured in feet per minute.

FPM (Feet per Minute) is the velocity of the airstream.

FL (Friction Loss) in inches water column (˝wg).

˝wg (Inches of water gage) is a unit of pressure equal to the pressure exerted by a column of water at standard temperature.

SP (Static Pressure) is the pressure in the duct that tends to burst or collapse the duct and is expressed in inches of water gage (˝wg).

V (Velocity) is equal to the flow rate (CFM) divided by the cross-sectional area of the air flow. V = CFM/Area (ft^2).

Step 1: Determine your **materials conveying requirements** in lbs/hr from experience and future projections. *Assumed to be 2,400 lbs/hr.*

Step 2: Convert pounds per hour to pounds per minute: *2,400 lbs/hr ÷ 60 = 40lbs/minute.*

Step 3: Find your **material type** in column A, Table 47-1. *We chose Wood Shavings, Heavy.*

Step 4: Reading across the row, determine your **material weight per cubic foot** (lbs/ft^3) from column B in Table 47-1. *We will use 15 lbs/ft^3.*

Step 5: Determine the **CFM required** to move 1 lb. of your material from column C, Table 47-1. *This equals 80 CFM.*

Step 6: Determine the **minimum conveying velocity** from column D, Table 47-1. *This equals 5600 FPM.*

Step 7: Determine the **suction pickup** from column E, Table 47-1. *This equals 3.0 ˝wg.*

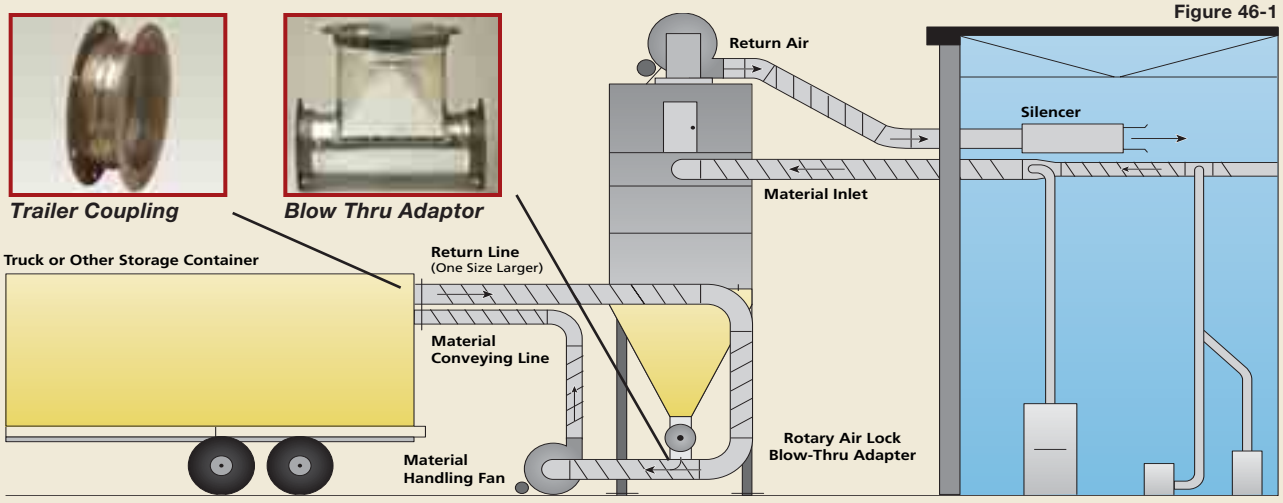
Step 8: Calculate the **total minimum CFM** requirement: Take (step 2) times (step 5). *Our example equals 80 CFM/lb. of material x 40 lbs/minute, which equals 3200 CFM minimum.*

Steps 9 thru 11 can be completed in one operation as follows: To determine the **system static pressure** requirements and **duct size**, find your **minimum conveying velocity** (FPM) from step 6. In the first column of table 47-2, find this velocity and read across the row to the first CFM greater than or equal to (step 8). This yields the **new actual CFM** for step 9. The **friction loss** for step 10 is located in the same column. Now move up to the top of the column to get your **duct size** for step 11.

In our example, reading across Table 47-2 from 5600 FPM to the first CFM greater than or equal to 3200 CFM yields a new actual CFM of 3696, a friction loss of 3.88 per 100 feet of duct, and a duct size of 11˝.

Step 12: Determine the **equivalent feet of straight duct** for horizontal and vertical pipe. We know 1' of horizontal

Figure 46-1



Trailer Loading

Bulk materials conveying calculations

pipe equals 1' of equivalent straight duct, and 1' of vertical pipe equals 2' of equivalent straight duct. *In our example, we have 200' of equivalent straight duct (there is no vertical duct in our example).*

Step 13: Determine the **equivalent feet of straight duct for all elbows**. *This equals 0 since there are no elbows in this example.*

Step 14: Determine the ***total*** **equivalent feet of straight duct** by adding steps 12 and 13. *This equals 200'.*

Step 15: Determine the **system friction loss**: divide step 14 by 100, then *times* step 11. *Our example as such: (200 ÷100) x 3.88 = 7.76*

Step 16: Enter the **suction pickup** from step 7.

Step 17: Calculate the **total SP system loss** by adding steps 15 and 16. *Our total is 10.76*.

Step 18 Add a 10% **safety factor** (1.1 times step 17). ***Our System fan minimum requirements equal: an 11" Fan inlet diameter with 11.84 "wg minimum at 3,696 CFM***

Note: If the material being conveyed will be passing through the fan, as in our drawing (Figure 46-1), the fan BHP will be significantly increased. Consult your fan representative.

Table 47-1

Materials	Approx. weight lbs/ft³	CFM per lb of material	Minimum conveying velocity (FPM)	Suction pickup "wg
A	B	C	D	E
Barley	38	38	5000	3.5
Beans, Soy	47	36	5200	4
Bran	16	56	3500	2
Cement, Portland	100	35	7000	5
Coal, Ashes	40	42	4500	3
Coal, Cinders	45	36	6000	4
Coal, Powdered	30	42	4000	3
Coffee beans	48	36	3500	3
Cork, Ground	15	59	3500	1.5
Corn, Cobs	25	44	5000	2.5
Corn, Meal	40	38	5500	3.5
Corn, Shelled	45	36	5500	3.5
Cotton, Dry	30	94	4000	2
Dust, Grinding	165	42	5000	3
Fruit, Dried	30	42	4000	3
Hair or Feathers, Dry	5	94	3000	1.5
Lime, Hydrated	55	42	5000	3
Malt, Dry	35	39	4800	3
Oats	26	44	4500	3
Wood Shavings Heavy	15	80	5600	3
Wood Shavings Light	7	73	4500	2

Table 47-2 Quantity of Air Flowing in CFM and Friction Loss (FL) per 100 feet

Duct Size	6"		7"		8"		9"		10"		11"		12"		14"		16"		18"		20"	
ft²	0.196		0.267		0.349		0.442		0.545		0.660		0.785		1.069		1.396		1.767		2.182	
Velocity FPM	CFM	FL	CFM	FL	CFM	FL	CFM	FL	CFM	FL	CFM	FL	CFM	FL	CFM	FL	CFM	FL	CFM	FL	CFM	FL
2800	550	2.18	748	1.80	977	1.53	1237	1.33	1527	1.17	1848	1.04	2199	0.93	2993	0.77	3910	0.66	4948	0.57	6109	0.50
3000	589	2.48	802	2.06	1047	1.75	1325	1.51	1636	1.33	1980	1.19	2356	1.07	3207	0.88	4189	0.75	5301	0.65	6545	0.57
3200	628	2.81	855	2.33	1117	1.98	1414	1.71	1745	1.50	2112	1.34	2513	1.20	3421	1.00	4468	0.85	5655	0.73	6981	0.65
3400	668	3.15	909	2.61	1187	2.22	1502	1.92	1854	1.69	2244	1.50	2670	1.35	3635	1.12	4747	0.95	6008	0.82	7418	0.72
3500	687	3.33	935	2.76	1222	2.34	1546	2.03	1909	1.78	2310	1.59	2749	1.43	3742	1.18	4887	1.01	6185	0.87	7636	0.77
3600	707	3.51	962	2.91	1257	2.47	1590	2.14	1964	1.88	2376	1.68	2827	1.51	3848	1.25	5027	1.06	6362	0.92	7854	0.81
3700	726	3.70	989	3.06	1292	2.60	1635	2.26	2018	1.98	2442	1.77	2906	1.59	3955	1.32	5166	1.12	6538	0.97	8072	0.85
3800	746	3.89	1016	3.22	1326	2.74	1679	2.37	2073	2.09	2508	1.86	2985	1.67	4062	1.38	5306	1.18	6715	1.02	8290	0.90
4000	785	4.29	1069	3.55	1396	3.02	1767	2.62	2182	2.30	2640	2.05	3142	1.84	4276	1.53	5585	1.30	7069	1.12	8727	0.99
4200	825	4.71	1122	3.90	1466	3.31	1856	2.87	2291	2.52	2772	2.25	3299	2.02	4490	1.67	5864	1.42	7422	1.23	9163	1.08
4400	864	5.14	1176	4.26	1536	3.62	1944	3.13	2400	2.76	2904	2.45	3456	2.21	4704	1.83	6144	1.55	7775	1.35	9599	1.18
4500	884	5.36	1203	4.44	1571	3.78	1988	3.27	2454	2.88	2970	2.56	3534	2.30	4811	1.91	6283	1.62	7952	1.40	9818	1.23
4600	903	5.59	1229	4.63	1606	3.94	2032	3.41	2509	3.00	3036	2.67	3613	2.40	4917	1.99	6423	1.69	8129	1.46	10036	1.29
4800	942	6.06	1283	5.02	1676	4.27	2121	3.70	2618	3.25	3168	2.89	3770	2.60	5131	2.16	6702	1.83	8482	1.59	10472	1.40
5000	982	6.55	1336	5.43	1745	4.61	2209	4.00	2727	3.51	3300	3.13	3927	2.81	5345	2.33	6981	1.98	8836	1.72	10908	1.51
5200	1021	7.06	1390	5.85	1815	4.97	2297	4.31	2836	3.79	3432	3.37	4084	3.03	5559	2.51	7261	2.13	9189	1.85	11345	1.63
5400	1060	7.58	1443	6.28	1885	5.34	2386	4.63	2945	4.07	3564	3.62	4241	3.26	5773	2.70	7540	2.29	9543	1.99	11781	1.75
5600	1100	8.13	1497	6.73	1955	5.72	2474	4.96	3054	4.36	3696	3.88	4398	3.49	5986	2.89	7819	2.46	9896	2.13	12217	1.87
5800	1139	8.69	1550	7.20	2025	6.12	2562	5.30	3163	4.66	3828	4.15	4555	3.73	6200	3.09	8098	2.63	10249	2.27	12654	2.00
6000	1178	9.27	1604	7.68	2094	6.52	2651	5.65	3273	4.97	3960	4.42	4712	3.98	6414	3.30	8378	2.80	10603	2.43	13090	2.13
7000	1374	12.42	1871	10.29	2443	8.74	3093	7.57	3818	6.66	4620	5.93	5498	5.33	7483	4.42	9774	3.75	12370	3.25	15272	2.86

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Material Conveying Calculations

Figure 48-1

1) Material pounds conveyed per hour	1)		
2) Material pounds per minute	2)		(step 1 divided by 60)
3) Material being conveyed	3)		(column A, Table 47-1)
4) Material weight, lbs/ft^3 (should be your actual)	4)		(column B, Table 47-1)
5) CFM per lb of material	5)		(column C, Table 47-1)
6) Minimum conveying velocity in FPM	6)		(column D, Table 47-1)
7) Suction pick-up, "wg	7)		(column E, Table 47-1)
8) Total minimum CFM required	8)		(step 2 times step 5)
9) Actual CFM for duct (see box to right)	9)		Go to table 47-2. Read across FPM line to the first CFM greater than the required CFM in step 8. This identifies step 9 & 10. Read the duct size at top of the column to get the **duct size** (step 10).
10) Friction loss (FL) per 100 feet (see box to right)	10)		
11) Duct size (see box to right)	11)		
12) Feet of (supply) straight duct — Horizontal pipe	12a)		
Vertical pipe x 2 =	12b)		+
	12)		= (total equivalent straight duct)

13) Number of Elbows	Qty.				
=		90° Elbows X		=	
=		60° Elbows X		=	+
=		45° Elbows X		=	+
=		30° Elbows X		=	+
			13)		= (total equivalent straight duct)

See Table 48-1 for elbow equivalent resistance.

14) Total equivalent feet of duct	14)	(step 12 plus step 13)
15) Friction loss	15)	(divide step 14 by 100 x step 11)
16) Suction pick-up	16)	(from step 7)
17) Total SP system loss	17)	(step 15 plus step 16)
18) Add 10% safety factor (1.1 times step 17)	18)	

SYSTEM FAN MINIMUM REQUIREMENTS

Minimum CFM requirement from step 10 | Min. "wg, step 18 | Fan inlet from step 9

Supplemantal Information:

1. To calculate for elbows in your system, see Table 48-1 or 55-1. Find your duct size in the first column. Read across the row to the elbow turn ratio you will be using. This is the equivalent resistance in feet of duct. Insert this into your calculation at step 13.

2. Make sure you use correct air density for location of fan. Standard Air Density is .075 at sea level.

WARNING:

Whereas fans are used in thousands of material conveying applications around the world, care must be used in their selection and location within each material conveying system.

The material should be crushed, shredded or pulverized before it passes through the fan to eliminate premature fan housing, fan wheel and/or bearing failure which could cause severe personal injury and/or complete system failure.

Please contact a sales engineer in your area for correct, safe selection for your specific application.

Table 48-1
Elbow Equivalent Resistance in Feet of Straight Pipe by Centerline Radius (CLR)

Duct Dia.	1.5 CLR Elbows				2.0 CLR Elbows				2.5 CLR Elbows			
	90°	60°	45°	30°	90°	60°	45°	30°	90°	60°	45°	30°
6"	12	8	6	4	7	5	4	2	6	4	3	2
7"	12	8	6	4	8	5	4	3	7	5	4	2
8"	13	9	7	4	9	6	5	3	7	5	4	2
9"	14	9	7	5	10	7	5	3	8	5	4	3
10"	15	10	8	5	10	7	5	3	8	5	4	3
11"	18	12	9	6	12	8	6	4	10	7	5	3
12"	20	13	10	7	14	9	7	5	11	7	6	4
14"	25	17	13	8	17	11	9	6	14	9	7	5
16"	30	20	15	10	21	14	11	7	17	11	9	6
18"	36	24	18	12	24	16	12	8	20	13	10	7
20"	41	27	21	14	28	19	14	9	23	15	12	8

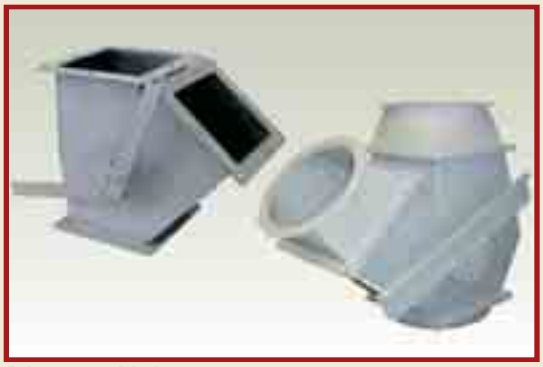
Materials Transfer

Pneumatic conveying & trailer /container loading components

Trailer Flange and Quick Disconnect

Silencer

Heavy Duty (HD) Flexible Hose (Black)



Diverter Valves

Ball Joint

Pneumatic Air-Actuated Blast Gate

Flange Clamp

Blow Thru Adapter

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Engineering Data

The following pages of data and physical properties are provided as references in the use and application of Spiral pipe and fittings.

The complexity of air system design engineering has changed dramatically since the 1950's even though the basic formulas have still remained the same. There have been significant additional theories added with new extremely complex and systematic formulas needed to satisfy these computations and provide for further enhancement of the overall systems of today. We have tried to give you the basic information needed for both methods. The old rule of thumb method seems to be the simplest method for smaller and moderate jobs. For complex jobs, we still recommend a certified engineer.

The new method of static loss calculations is far too complex for the average Joe. Therefore, we have given you the quick reference chart approach to simplify and speed up the process.

Basic Definitions

The following are used to describe airflow and will be used extensively in this catalog. Standard air is defined at standard atmospheric pressure (14.7 psia), room temperature (70^0 F) and zero water content; its value is normally taken to be 0.075 lbs/ ft^3.

The volumetric flow rate, many times referred to as "volumes," is defined as the volume or quantity of air that passes a given location per unit of time, i.e. (cfm). It is related to the average velocity and the flow cross-section area in ft^2 by the equation

Q=VA

where Q = volumetric flow rate or cfm,
V= average velocity or fpm, and
A= cross-sectional area in ft^2.

Given any two of these three quantities, the third can readily be determined as follows:

Q=VA or V=Q/A or A=Q/V

There are three different but mathematically related pressures associated with a moving air stream. Static pressure (SP) is defined as the pressure in the duct that tends to burst or collapse the duct and is expressed in inches of water gage (˝wg).

Velocity pressure (VP) is defined as that pressure required to accelerate air from zero velocity to some velocity (V) and is proportional to the kinetic energy of the air stream. Using standard air, the relationship between V and VP is given by

$$V = 4005\sqrt{VP} \quad \text{or} \quad VP = \left(\frac{V}{4005}\right)^2$$

VP will only be exerted in the direction of airflow and is always positive.

Total pressure (TP) is defined as the algebraic sum of the static and velocity pressures or TP=SP+VP. Total pressure can be positive or negative with respect to atmospheric pressure and is a measure of energy content of the air stream, always dropping as the flow proceeds downstream through a duct. The only place it will rise is across the fan. Total pressure can be measured with a pitot tube pointing directly upstream and connected to a manometer.

Principles of air flow

Two basic principles of fluid mechanics govern the flow of air in industrial ventilation systems: conservation of mass and conservation of energy. These are essentially bookkeeping laws which state that all mass and all energy must be completely accounted for and it is important to know what simplifying assumptions are included in the principles discussed below:

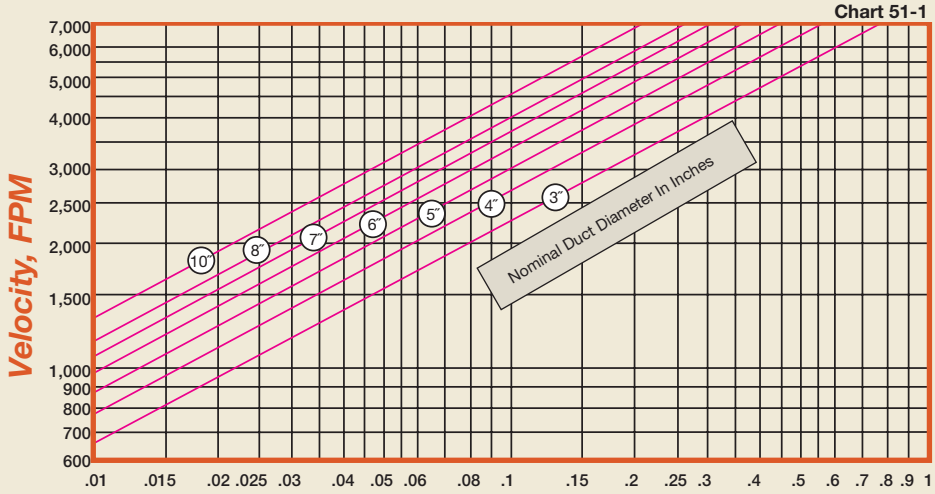
1. Heat transfer effects are neglected. However, if the temperature inside the duct is significantly different than the air temperature surrounding the duct, heat transfer will occur. This will lead to changes in the duct air temperature and hence in the volumetric flow rate.
2. Compressiblity effects are neglected. However, if the overall pressure drop from the start of the system to the fan is greater than about 20 ˝wg, then the density needs to be accounted for.
3. The air is assumed to be dry. Water vapor in the air stream will lower the air density, and correction for this effect, if present, should be made.
4. The weight and volume of the contaminant in the air stream is ignored. This is permissible for the contaminant concentrations in typical exhaust ventilation systems. For high concentrations of solids or significant amounts of some gases other than air, corrections for this effect should be included. ***(Continued on page 54)***

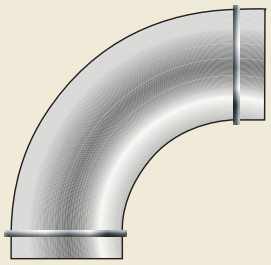
Engineering Data

Static Pressure (SP) Loss for 90° and 45° Die-Formed Elbows

Static Pressure Loss of Die-Formed 90° Elbows

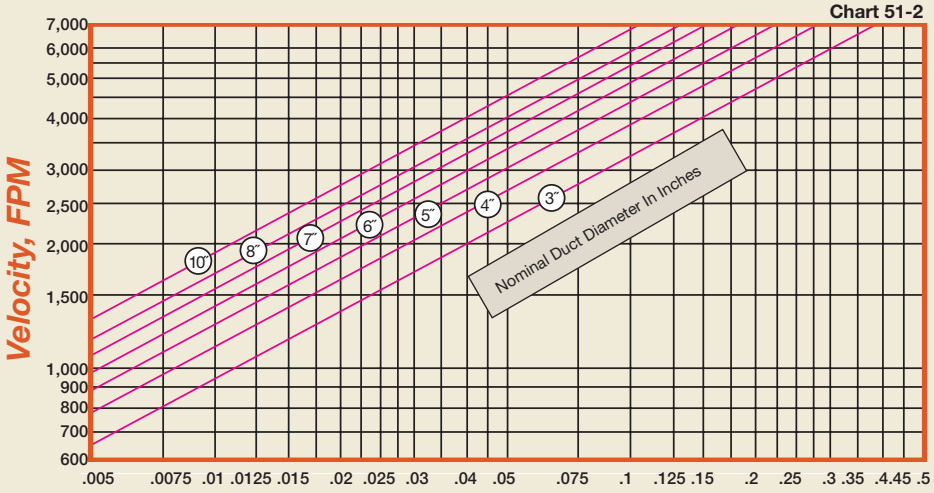
Chart 51-1





Static Pressure Loss of Die-Formed 45° Elbows

Chart 51-2



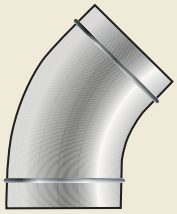


Table 51-1: Duct Pressure Loss Results for Stamped (1.5CLR) Elbows @ 4000 ft/min with .999 (VP)

Size	3"	4"	5"	6"	7"	8"	9"	10"	12"	14"	Elbow Loss Factor
Straight Duct Loss (inches Water):	10.15	7.04	5.31	4.22	3.49	2.95	2.55	2.24	1.79	1.48	
Total Duct Loss (˝wg) 90º Stamped	10.30	7.18	5.46	4.37	3.63	3.01	2.70	2.39	1.94	1.63	0.15
Total Duct Loss (˝wg) 45º Stamped	10.22	7.11	5.38	4.30	3.56	3.14	2.62	2.32	1.86	1.56	0.075
Flow Rate: SCFM	192.5	342.3	534.8	770.2	1068	1396	1732.5	2140	3080	4194	

Based per 100 feet duct length • viscosity (cP).018 • Inlet pressure (psig) 0 • Temp (F) 70° • Galvanized metal roughness (ft) .0005 • Flow region Turbulent, 4000fpm • friction factor 0.02 • velocity pressure .999

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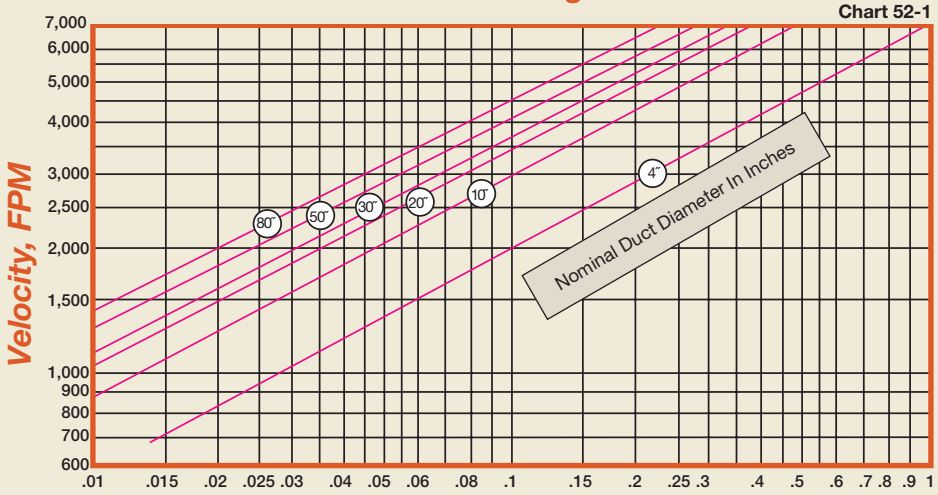
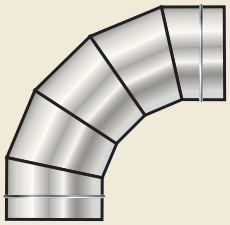
Static Pressure (SP) Loss for 90° and 45°, 5-Gore and 3-Gore Elbows

Static Pressure Loss of 5-gore 90° Elbows

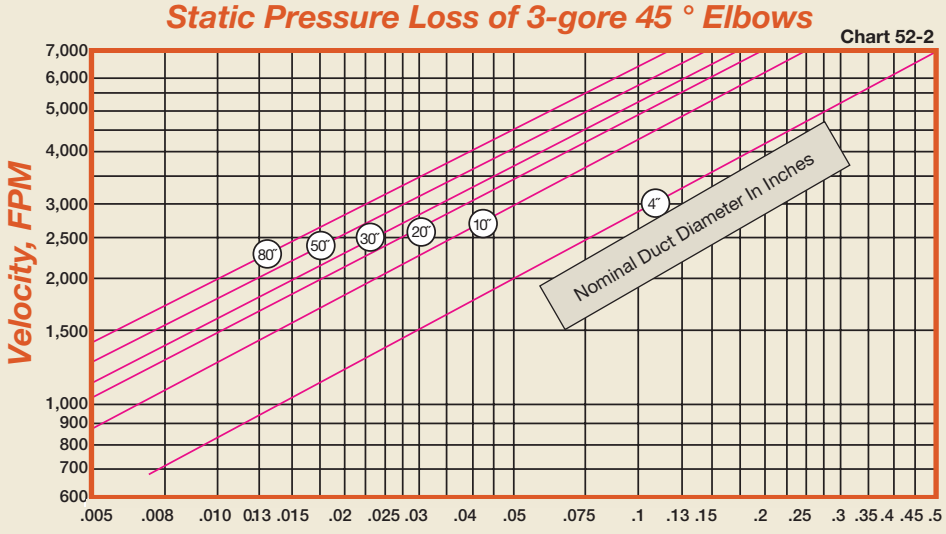
Chart 52-1





Static Pressure Loss of 3-gore 45 ° Elbows

Chart 52-2



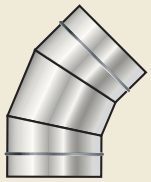


Table 52-1: Duct Pressure Loss Results for Gored (1.5CLR) Elbows @ 4000 ft/min with .999 (VP)

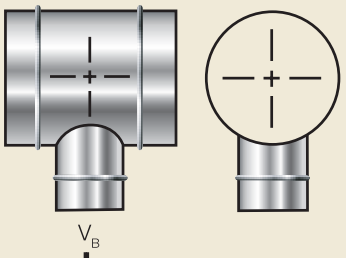
Size	3”	4”	5”	6”	7”	8”	9”	10”	12”	14”	Elbow Loss Factor
Straight Duct Loss (inches Water):	10.15	7.04	5.31	4.22	3.49	2.95	2.55	2.24	1.79	1.48	
Total Duct Loss (“wg) 90⁰ 5 Gore	10.39	7.25	5.55	4.46	3.72	3.19	2.79	2.48	2.03	1.72	0.24
Total Duct Loss (“wg) 45⁰ 3 Gore	10.32	7.21	5.48	4.39	3.65	3.21	2.72	2.41	1.96	1.65	0.17
Flow Rate: SCFM	192.5	342.3	534.8	770.2	1068	1396	1732	2140	3080	4194	

Based per 100 feet duct length • viscosity (cP).018 • Inlet pressure (psig) 0 • Temp (F) 70° • Galvanized metal roughness (ft) .0005 • Flow region Turbulent, 4000fpm • friction factor 0.02 • velocity pressure .999

Engineering Data

Static Pressure (SP) Loss in 90° Tees & Conical Tees

Static Pressure loss in 90° Tee

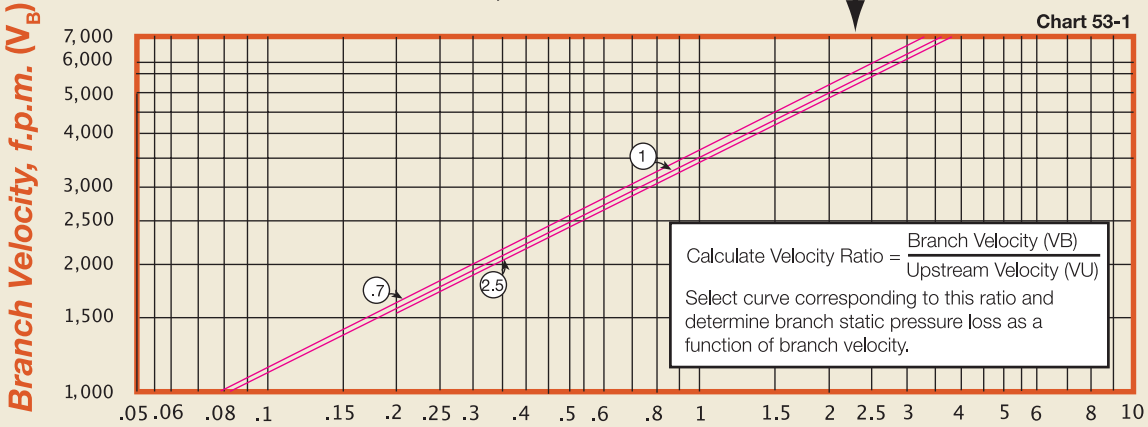


Example: Main (V_U) = 4000, Branch (V_B) = 6000

Velocity Ratio = $\frac{V_B}{V_U} = \frac{6000}{4000} = 1.5$

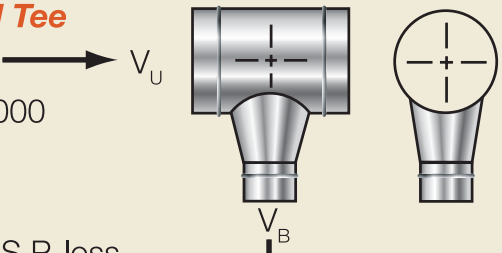
From Chart: 1.5 Ratio @ 6000 f.p.m. ≅ 2.8" S.P. loss

Chart 53-1



Static Pressure Loss, Inches of Water

Static Pressure loss in 90° Conical Tee

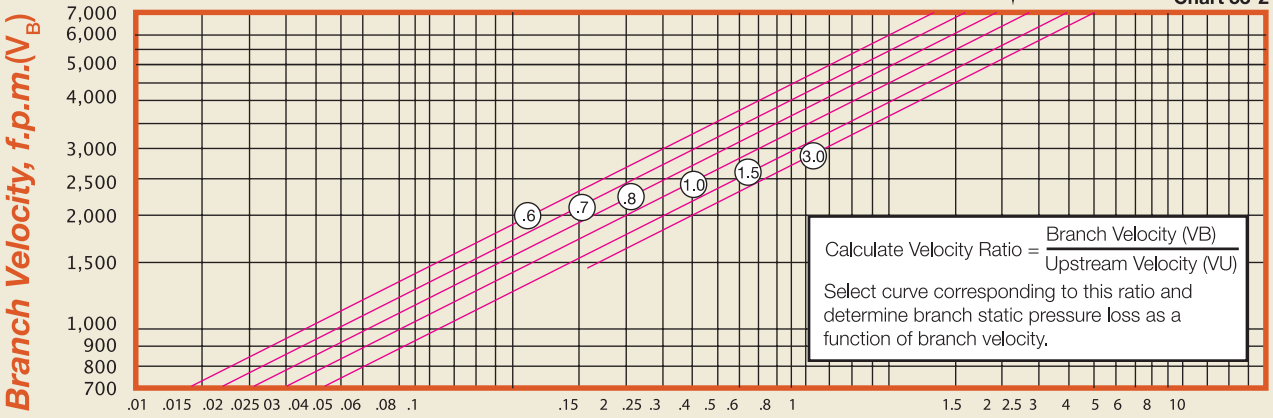


Example: Main (V_U) = 4000, Branch (V_B) = 6000

Velocity Ratio = $\frac{V_B}{V_U} = \frac{6000}{4000} = 1.5$

From Chart: 1.5 Ratio @ 6000 f.p.m. ≅ 2.3" S.P. loss

Chart 53-2



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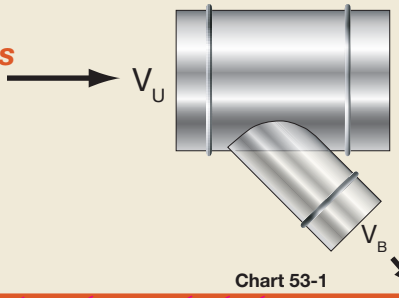
Static Pressure (SP) Loss in 45° Laterals & Branch Entry Loss

Static Pressure loss in 45° Laterals

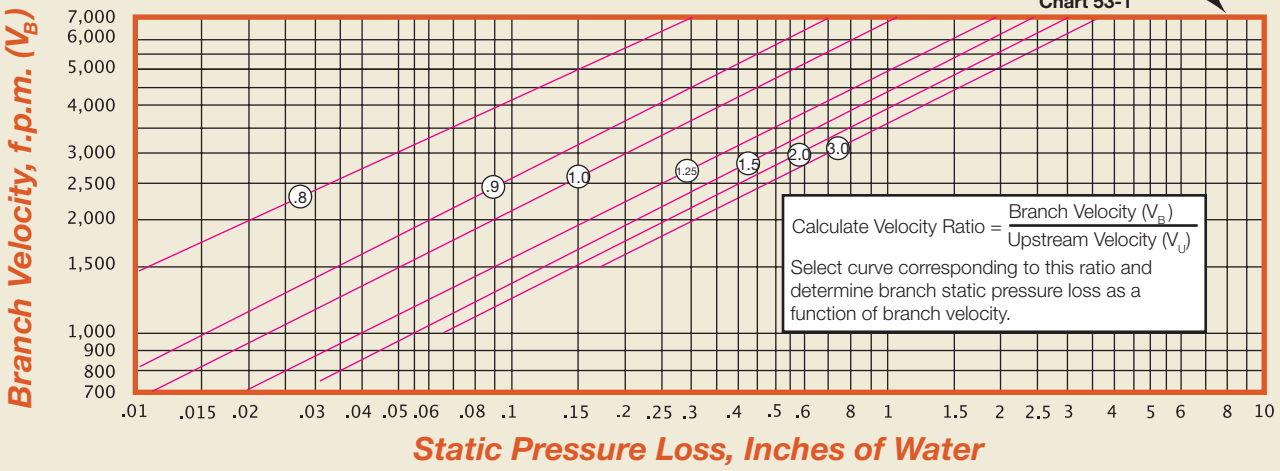


Example: Main (V_U) = 4000, Branch (V_B) = 6000

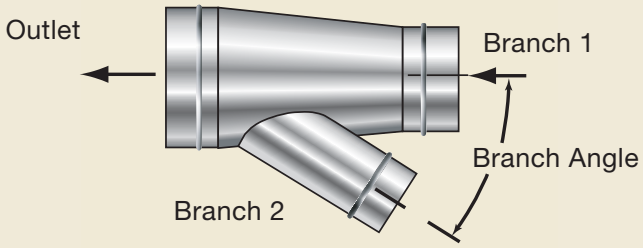
$$\text{Velocity Ratio} = \frac{V_B}{V_U} = \frac{6000}{4000} = 1.5$$

From Chart: 1.5 Ratio @ 6000 f.p.m. ≅ 1.9" S.P. loss

Chart 53-1



Branch Entries



Note that branch entry loss is assumed to occur in the branch for calculations. Enlargement regain should not be included in branch entry enlargements. Any losses due to acceleration of combined flow should be added to the calculations in the outlet pipe.

Table 54-1: Equivalent Resistance in Feet of Straight Duct

Size	30⁰	45⁰	Size	30⁰	45⁰
3"	3	4	20"	18	28
4"	4	6	22"	20	31
5"	5	7	24"	22	34
6"	6	9	26"	24	37
7"	6	10	28"	26	40
8"	7	11	30"	28	43
9"	8	13	32"	29	45
10"	9	14	34"	31	48
12"	11	17	36"	33	51
14"	13	20	38"	35	54
16"	15	23	40"	37	57
18"	17	26	42"	39	60

(Continued from page 50)

Conservation of mass requires that the net change of mass flow rate must be zero. If the effects discussed on page 51 are negligible, then the density will be constant and the net change of volumetric flow rate (Q) must be zero. Therefore, the flow rate that enters a hood must be the same as the flow rate that passes through the duct leading from the hood. At a branch entry, the sum of the two flow rates that enter the fitting must be equivalent to the total leaving the fitting.

Engineering Data

Equivalent Resistance & Friction Loss Quick Reference Charts

Table 55-1: Elbow Equivalent Resistance In Feet Of Straight Pipe By Center Line Radius (CLR)

	1.5 CLR				2.0 CLR				2.5 CLR			
Size	90° Elbow	60° Elbow	45° Elbow	30° Elbow	90° Elbow	60° Elbow	45° Elbow	30° Elbow	90° Elbow	60° Elbow	45° Elbow	30° Elbow
3”	5	3	3	2	3	2	2	1	3	2	2	1
4”	6	4	3	2	4	3	2	1	4	3	2	1
5”	9	6	5	3	6	4	3	2	5	3	3	2
6”	12	8	6	4	7	5	4	2	6	4	3	2
8”	13	9	7	4	9	6	5	3	7	5	4	2
10”	15	10	8	5	10	7	5	3	8	5	4	3
12”	20	13	10	7	14	9	7	5	11	7	6	4
14”	25	17	13	8	17	11	9	6	14	9	7	5
16”	30	20	15	10	21	14	11	7	17	11	9	6
18”	36	24	18	12	24	16	12	8	20	13	10	7
20”	41	28	21	14	28	19	14	9	23	15	12	8
22”	46	31	23	15	32	21	16	11	26	17	13	9
24”	57	38	29	19	40	27	20	13	32	21	16	11
30”	74	50	37	24	51	34	26	17	41	28	21	14
36”	93	62	47	31	64	43	32	21	52	35	26	17
40”	105	70	53	35	72	48	36	24	59	40	30	20
48”	130	87	65	43	89	60	45	29	73	49	37	24

Losses in Elbows and Fittings. When an air stream undergoes change of either direction or velocity, a dynamic loss occurs. Unlike friction losses in straight duct, fitting losses are due to internal turbulance rather than skin friction. Hence roughness of material has but slight effect over a wide range of moderately smooth materials. Fitting losses can be expressed as equivalent length of straight duct; or as a fraction of velocity pressure; or directly in inches of water gage (˝wg).

Table 55-2: Friction Loss In Inches Of Water (˝WG) Per 100 Feet Of Spiral Pipe

Duct Dia.	Velocity FPM				Duct Dia.	Velocity FPM				Duct Dia.	Velocity FPM			
	3500	4000	4500	5000		3500	4000	4500	5000		3500	4000	4500	5000
3”	7.75	9.99	12.50	15.27	17”	0.93	1.20	1.51	1.84	44”	0.29	0.38	0.47	0.58
4”	5.46	7.03	8.80	10.75	18”	0.87	1.12	1.40	1.72	46”	0.28	0.36	0.45	0.55
5”	4.16	5.36	6.70	8.19	20”	0.77	0.99	1.23	1.51	48”	0.26	0.34	0.42	0.52
6”	3.33	4.29	5.36	6.55	22”	0.68	0.88	1.01	1.34	50”	0.25	0.32	0.40	0.49
7”	2.76	3.55	4.44	5.43	24”	0.61	0.79	0.99	1.21	52”	0.24	0.31	0.38	0.47
8”	2.34	3.02	3.78	4.61	26”	0.56	0.72	0.90	1.01	54”	0.23	0.29	0.37	0.45
9”	2.03	2.62	3.27	4.00	28”	0.51	0.65	0.82	1.00	56”	0.22	0.28	0.35	0.43
10”	1.78	2.30	2.88	3.51	30”	0.47	0.60	0.75	0.92	58”	0.21	0.27	0.34	0.41
11”	1.59	2.05	2.56	3.13	32”	0.43	0.56	0.70	0.85	60”	0.20	0.26	0.32	0.39
12”	1.43	1.84	2.30	2.81	34”	0.40	0.52	0.65	0.79					
13”	1.30	1.67	2.09	2.55	36”	0.37	0.48	0.60	0.74					
14”	1.18	1.53	1.91	2.33	38”	0.35	0.45	0.56	0.69					
15”	1.09	1.40	1.75	2.14	40”	0.33	0.42	0.53	0.65					
16”	1.01	1.30	1.62	1.98	42”	0.31	0.40	0.50	0.61					

$$h_f = 2.74 \frac{(V/1000)^{1.9}}{D^{1.22}}$$

h_f = Friction losses in a duct, “wg.
V = Duct Velocity, fpm
D = Duct Diameter, Inches

This equation gives the friction losses, expressed as “wg per 100 feet of pipe, for standard air of 0.075 lbm/ft³ density flowing through average, clean, round galvanized pipe having approximately 40 slip joints per 100 feet (k = 0.0005 ft.).

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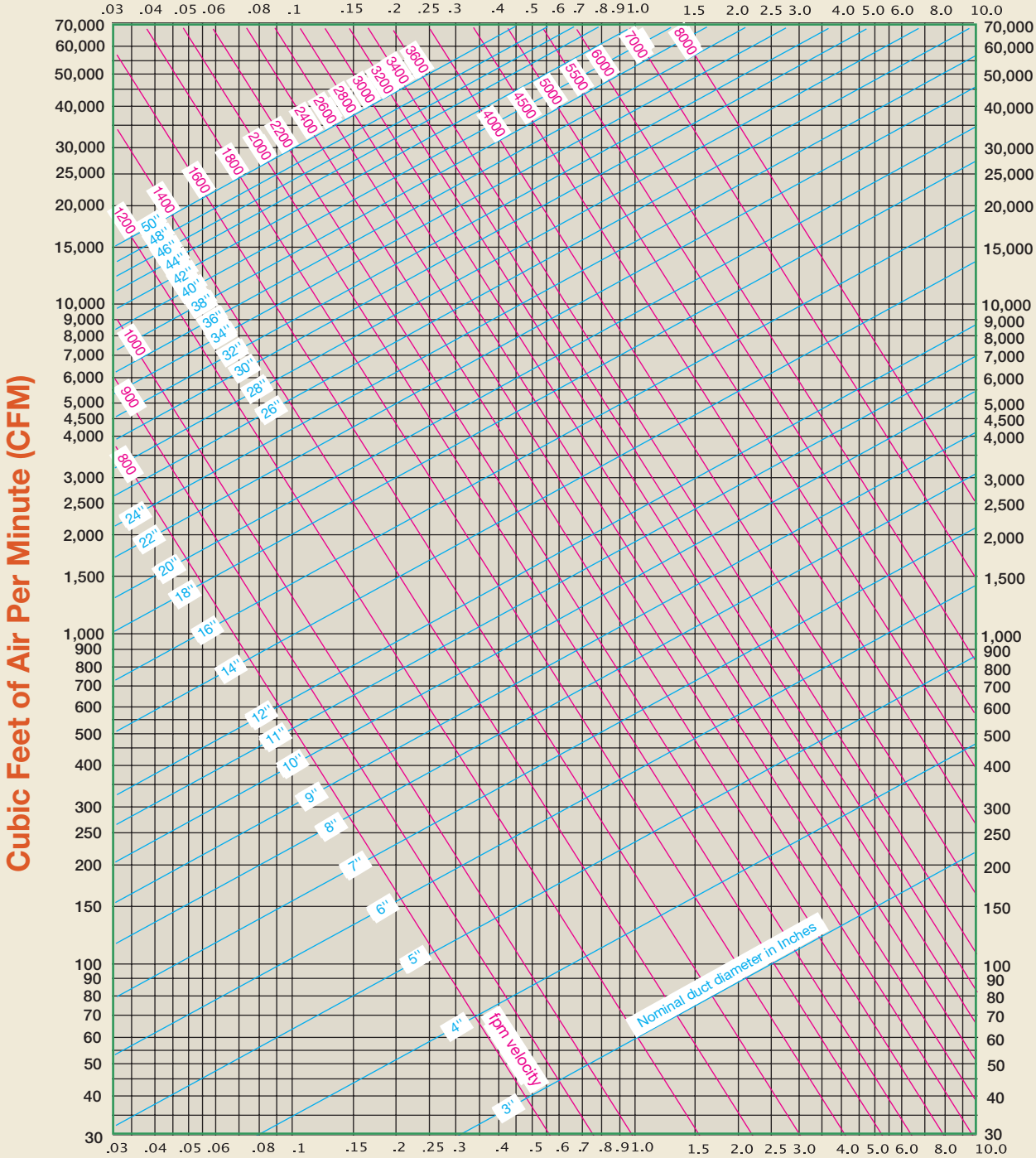
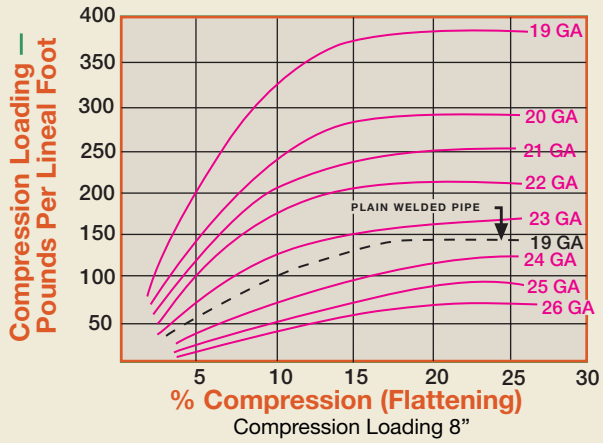
Static Pressure (Friction) Loss of Spiral Pipe



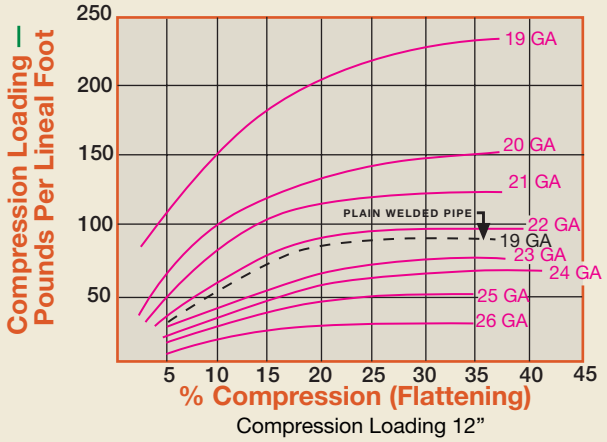
Engineering Data

Compression & Deflection Properties of Spiral Pipe, Static Pressure (SP) Loss in Flexible Rubber Hose

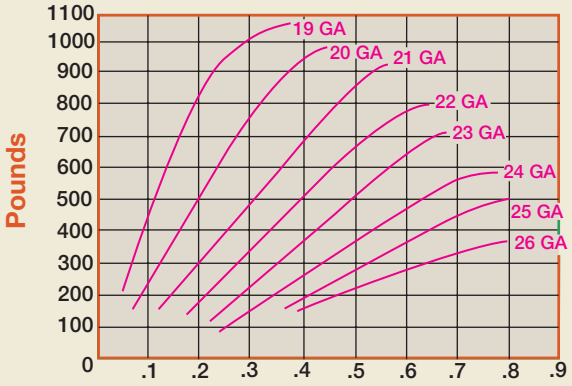
Physical Properties of Spiral Pipe



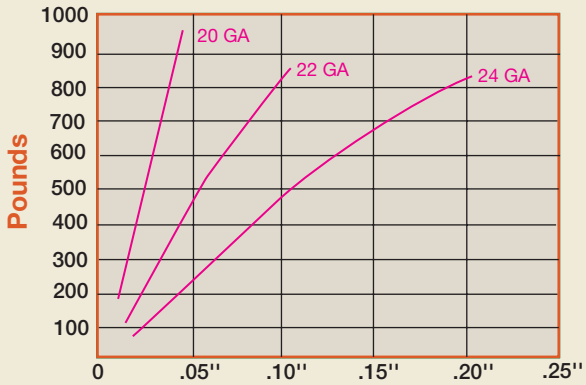
Compression Loading 8" Diameter of Spiral Pipe



Compression Loading 12" Diameter of Spiral Pipe



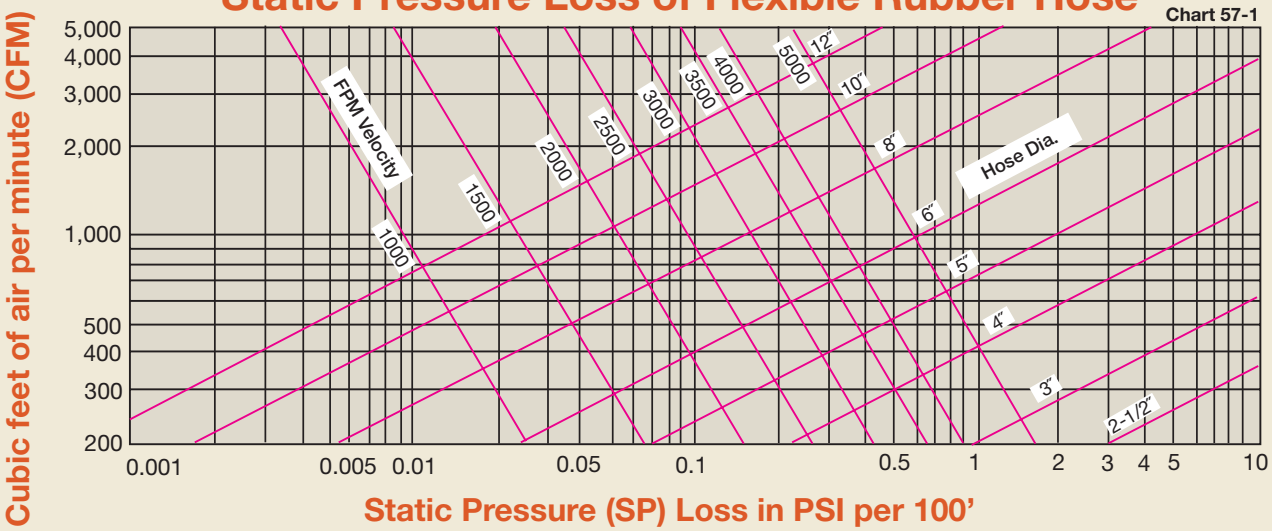
8" pipe, End-Supported with Center Load



12" pipe, End-Supported with Center Load

Static Pressure Loss of Flexible Rubber Hose

Chart 57-1



Static Pressure (SP) Loss in PSI per 100'

To convert to inches of water gage multiply by 27.7

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Diameter, Gauge & StrengthProperties; Collapsing & Bursting Pressures

Diameters, Gauge, and Strength Properties of Spiral Pipe

Nominal Diameter (inches)	Steel Guage		Bursting Pressure (Seam Failure) P.S.I		Internal Negative Pressure To Collapse Standard Pipe	
	Std.	Max.	Std.	Max.	In. ˝wg	PSI
3	24	22	*	*	**	**
4	24	20	500	*	**	**
5	24	18	350	*	**	**
6	24	18	275	*	**	**
7	24	18	220	*	**	**
8	24	18	175	460	**	**
9	24	18	150	375	304	11.0
10	24	18	135	325	193	7.0
11	24	18	115	275	111	4.0
12	24	18	95	240	83	3.0
13	24	18	85	220	66	2.4
14	24	18	80	185	47	1.7
15	24	18	72	170	44	1.6
16	24	18	65	160	39	1.4
17	24	18	58	145	36	1.3
18	24	18	53	140	35	1.25
20	24	18	47	120	33	1.2
22	24	18	41	100	33	1.2
24	22	18	48	87	33	1.2
26	22	18	42	78	***	***
28	22	18	37	68	***	***
30	22	18	33	60	***	***
32	22	18	30	55	***	***
34	22	18	28	52	***	***
36	22	18	27	48	***	***
42	22	18	29	37	***	***
48	22	18	25	32	***	***

*Did not fail at 500 PSI ** Did not fail at -14.7 PSI (-407 in. H_2O)
*** Less than 1.2 PSI

Calculation of wall thickness to diameter ratio: $\left(\frac{T}{D}\right)$

Example: For 24 gauge steel and duct diameter of 13”.

$\left(\frac{T}{D}\right)$ = .0296/13 = .0023

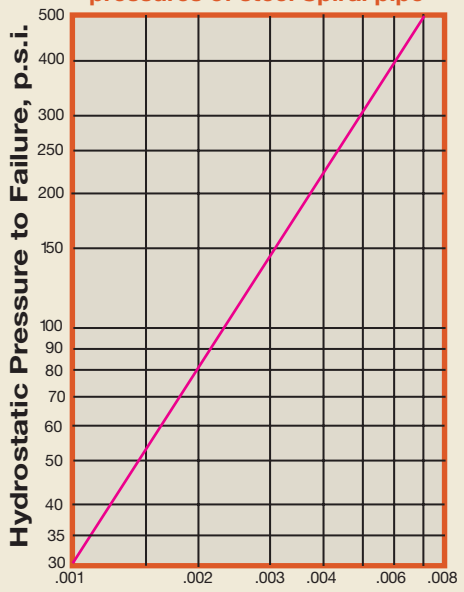
Above reference, for lower charts, to predict bursting and collapsing pressures.

Gauge	Mean Thickness
16	.0635
18	.0516
20	.0396
22	.0336
24	.0276
26	.0217

1 PSI = 27.7 ˝wg 1 ˝wg = .0361 PSI

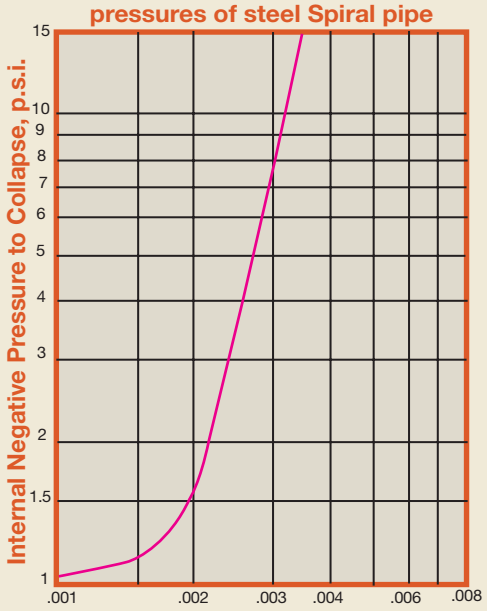
Properties are approximate, based on both empirical and extrapolated data

Chart to predict bursting pressures of steel Spiral pipe



Refer to upper right corner of page for more details

Chart to predict collapsing pressures of steel Spiral pipe



Refer to upper right corner of page for more details

Capacity of Round Pipe 3 to 60 Inches Diameter, 300 to 2400 FPM

Q = VA Q = CFM V = VELOCITY A = AREA IN FT²			EXHAUST GRILLES					EHAUST RISERS AND VENT STACKS							EXHAUST MAINS				GASES AND FUMES		
						SUPPLY FLUES AND RISERS															
										HORIZONTAL SUPPLY DUCTS										
Velocity FPM			300	350	400	450	500	550	600	650	700	750	800	900	1000	1200	1400	1500	1800	2000	2200	2400
Dia. In.	AREA Sq. In.	AREA Sq. Ft.	QUANTITY OF AIR FLOWING, IN CFM																		
3”	7.069	0.0491	15	17	20	22	25	27	29	32	34	37	39	44	49	59	69	74	88	98	108	118
4”	12.566	0.0873	26	31	35	39	44	48	52	57	61	65	70	79	87	105	122	131	157	175	192	209
5”	19.635	0.1364	41	48	55	61	68	75	82	89	95	102	109	123	136	164	191	205	245	273	300	327
6”	28.274	0.1964	59	69	79	88	98	108	118	128	137	147	157	177	196	236	275	295	353	393	432	471
7”	38.485	0.2673	80	94	107	120	134	147	160	174	187	200	214	241	267	321	374	401	481	535	588	641
8”	50.266	0.3491	105	122	140	157	175	192	209	227	244	262	279	314	349	419	489	524	628	698	768	838
9”	63.617	0.4418	133	155	177	199	221	243	265	287	309	331	353	398	442	530	619	663	795	884	972	1060
10”	78.540	0.5454	164	191	218	245	273	300	327	355	382	409	436	491	545	655	764	818	982	1091	1200	1309
12”	113.098	0.7854	236	275	314	353	393	432	471	511	550	589	628	707	785	942	1100	1178	1414	1571	1728	1885
14”	153.938	1.0690	321	374	428	481	535	588	641	695	748	802	855	962	1069	1283	1497	1604	1924	2138	2352	2566
15”	176.715	1.2272	368	430	491	552	614	675	736	798	859	920	982	1104	1227	1473	1718	1841	2209	2454	2700	2945
16”	201.062	1.3963	419	489	559	628	698	768	838	908	977	1047	1117	1257	1396	1676	1955	2094	2513	2793	3072	3351
17”	226.981	1.5763	473	552	631	709	788	867	946	1025	1103	1182	1261	1419	1576	1892	2207	2364	2837	3153	3468	3783
18”	254.470	1.7672	530	619	707	795	884	972	1060	1149	1237	1325	1414	1590	1767	2121	2474	2651	3181	3534	3888	4241
20”	314.160	2.1817	655	764	873	982	1091	1200	1309	1418	1527	1636	1745	1964	2182	2618	3054	3273	3927	4363	4800	5236
22”	380.134	2.6398	792	924	1056	1188	1320	1452	1584	1716	1848	1980	2112	2376	2640	3168	3696	3960	4752	5280	5808	6336
24”	452.390	3.1416	942	1100	1257	1414	1571	1728	1885	2042	2199	2356	2513	2827	3142	3770	4398	4712	5655	6283	6912	7540
26”	530.930	3.6870	1106	1290	1475	1659	1844	2028	2212	2397	2581	2765	2950	3318	3687	4424	5162	5531	6637	7374	8111	8849
28”	615.754	4.2761	1283	1497	1710	1924	2138	2352	2566	2779	2993	3207	3421	3848	4276	5131	5986	6414	7697	8552	9407	10263
30”	706.860	4.9088	1473	1718	1964	2209	2454	2700	2945	3191	3436	3682	3927	4418	4909	5891	6872	7363	8836	9818	10799	11781
32”	804.250	5.5851	1676	1955	2234	2513	2793	3072	3351	3630	3910	4189	4468	5027	5585	6702	7819	8378	10053	11170	12287	13404
34”	907.922	6.3050	1892	2207	2522	2837	3153	3468	3783	4098	4414	4729	5044	5675	6305	7566	8827	9458	11349	12610	13871	15132
36”	1017.878	7.0686	2121	2474	2827	3181	3534	3888	4241	4595	4948	5301	5655	6362	7069	8482	9896	10603	12723	14137	15551	16965
38”	1134.118	7.8758	2363	2757	3150	3544	3938	4332	4725	5119	5513	5907	6301	7088	7876	9451	11026	11814	14176	15752	17327	18902
40”	1256.640	8.7267	2618	3054	3491	3927	4363	4800	5236	5672	6109	6545	6981	7854	8727	10472	12217	13090	15708	17453	19199	20944
42”	1385.446	9.6212	2886	3367	3848	4330	4811	5292	5773	6254	6735	7216	7697	8659	9621	11545	13470	14432	17318	19242	21167	23091
44”	1520.534	10.5593	3168	3696	4224	4752	5280	5808	6336	6864	7391	7919	8447	9503	10559	12671	14783	15839	19007	21119	23230	25342
46”	1661.906	11.5410	3462	4039	4616	5193	5771	6348	6925	7502	8079	8656	9233	10387	11541	13849	16157	17312	20774	23082	25390	27698
48”	1809.562	12.5664	3770	4398	5027	5655	6283	6912	7540	8168	8796	9425	10053	11310	12566	15080	17593	18850	22620	25133	27646	30159
50”	1963.500	13.6354	4091	4772	5454	6136	6818	7499	8181	8863	9545	10227	10908	12272	13635	16363	19090	20453	24544	27271	29998	32725
52”	2123.722	14.7481	4424	5162	5899	6637	7374	8111	8849	9586	10324	11061	11798	13273	14748	17698	20647	22122	26547	29496	32446	35395
54”	2290.226	15.9044	4771	5567	6362	7157	7952	8747	9543	10338	11133	11928	12723	14314	15904	19085	22266	23857	28628	31809	34990	38170
56”	2463.014	17.1043	5131	5986	6842	7697	8552	9407	10263	11118	11973	12828	13683	15394	17104	20525	23946	25656	30788	34209	37629	41050
58”	2642.086	18.3478	5504	6422	7339	8257	9174	10091	11009	11926	12843	13761	14678	16513	18348	22017	25687	27522	33026	36696	40365	44035
60”	2827.440	19.6350	5891	6872	7854	8836	9818	10799	11781	12763	13745	14726	15708	17672	19635	23562	27489	29453	35343	39270	43197	47124

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Spiral Manufacturing Co., Inc.
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Capacity of Round Pipe 3 to 60 Inches Diameter, 2500 to 7000 FPM

Q = VA Q = CFM V = VELOCITY A = AREA IN FT²			GAS & FUMES			LINT, BAKELITE POWDER, COTTON, FLOOR						PULVERIZED COAL, FOUNDRY DUST, METAL DUST , OATS, RUBBER BUFFINGS, DRY SAWDUST AND SHAVINGS, WOOD DUST			ALUMINUM DUST, COTTON SEED, KNOTS, BARK, PAPER TRIM, GREEN SHAVINGS, WOOD CHIPS, WOOL			BARLEY, CORN, GRANITE DUST, HOG WASTE, RYE,WET SAWDUST, SUGAR, WHEAT, WOOD BLOCK AND FIBER			CEMENT DUST, SALT, SAND	
Velocity FPM			2500	2600	2800	3000	3200	3400	3600	3800	4000	4200	4400	4600	4800	5000	5200	5600	6000	6400	6800	7000
Dia. In.	AREA		QUANTITY OF AIR FLOWING, IN CFM																			
	Sq. In.	Sq. Ft.																				
3”	7.069	0.0491	123	128	137	147	157	167	177	187	196	206	216	226	236	245	255	275	295	314	334	344
4”	12.566	0.0873	218	227	244	262	279	297	314	332	349	367	384	401	419	436	454	489	524	559	593	611
5”	19.635	0.1364	341	355	382	409	436	464	491	518	545	573	600	627	655	682	709	764	818	873	927	954
6”	28.274	0.1964	491	511	550	589	628	668	707	746	785	825	864	903	942	982	1021	1100	1178	1257	1335	1374
7”	38.485	0.2673	668	695	748	802	855	909	962	1016	1069	1122	1176	1229	1283	1336	1390	1497	1604	1710	1817	1871
8”	50.266	0.3491	873	908	977	1047	1117	1187	1257	1326	1396	1466	1536	1606	1676	1745	1815	1955	2094	2234	2374	2443
9”	63.617	0.4418	1104	1149	1237	1325	1414	1502	1590	1679	1767	1856	1944	2032	2121	2209	2297	2474	2651	2827	3004	3093
10”	78.540	0.5454	1364	1418	1527	1636	1745	1854	1964	2073	2182	2291	2400	2509	2618	2727	2836	3054	3273	3491	3709	3818
12”	113.098	0.7854	1964	2042	2199	2356	2513	2670	2827	2985	3142	3299	3456	3613	3770	3927	4084	4398	4712	5027	5341	5498
14”	153.938	1.0690	2673	2779	2993	3207	3421	3635	3848	4062	4276	4490	4704	4917	5131	5345	5559	5986	6414	6842	7269	7483
15”	176.715	1.2272	3068	3191	3436	3682	3927	4172	4418	4663	4909	5154	5400	5645	5891	6136	6381	6872	7363	7854	8345	8590
16”	201.062	1.3963	3491	3630	3910	4189	4468	4747	5027	5306	5585	5864	6144	6423	6702	6981	7261	7819	8378	8936	9495	9774
17”	226.981	1.5763	3941	4098	4414	4729	5044	5359	5675	5990	6305	6620	6936	7251	7566	7881	8197	8827	9458	10088	10719	11034
18”	254.470	1.7672	4418	4595	4948	5301	5655	6008	6362	6715	7069	7422	7775	8129	8482	8836	9189	9896	10603	11310	12017	12370
20”	314.160	2.1817	5454	5672	6109	6545	6981	7418	7854	8290	8727	9163	9599	10036	10472	10908	11345	12217	13090	13963	14835	15272
22”	380.134	2.6398	6600	6864	7391	7919	8447	8975	9503	10031	10559	11087	11615	12143	12671	13199	13727	14783	15839	16895	17951	18479
24”	452.390	3.1416	7854	8168	8796	9425	10053	10681	11310	11938	12566	13195	13823	14451	15080	15708	16336	17593	18850	20106	21363	21991
26”	530.930	3.6870	9218	9586	10324	11061	11798	12536	13273	14011	14748	15485	16223	16960	17698	18435	19172	20647	22122	23597	25072	25809
28”	615.754	4.2761	10690	11118	11973	12828	13683	14539	15394	16249	17104	17959	18815	19670	20525	21380	22236	23946	25656	27367	29077	29932
30”	706.860	4.9088	12272	12763	13745	14726	15708	16690	17672	18653	19635	20617	21599	22580	23562	24544	25526	27489	29453	31416	33380	34361
32”	804.250	5.5851	13963	14521	15638	16755	17872	18989	20106	21223	22340	23457	24574	25691	26808	27925	29042	31276	33510	35744	37978	39095
34”	907.922	6.3050	15763	16393	17654	18915	20176	21437	22698	23959	25220	26481	27742	29003	30264	31525	32786	35308	37830	40352	42874	44135
36”	1017.878	7.0686	17672	18378	19792	21206	22620	24033	25447	26861	28274	29688	31102	32516	33929	35343	36757	39584	42412	45239	48066	49480
38”	1134.118	7.8758	19690	20477	22052	23627	25203	26778	28353	29928	31503	33078	34654	36229	37804	39379	40954	44105	47255	50405	53556	55131
40”	1256.640	8.7267	21817	22689	24435	26180	27925	29671	31416	33161	34907	36652	38397	40143	41888	43633	45379	48869	52360	55851	59341	61087
42”	1385.446	9.6212	24053	25015	26939	28863	30788	32712	34636	36560	38485	40409	42333	44257	46182	48106	50030	53878	57727	61575	65424	67348
44”	1520.534	10.5593	26398	27454	29566	31678	33790	35902	38013	40125	42237	44349	46461	48573	50684	52796	54908	59132	63356	67579	71803	73915
46”	1661.906	11.5410	28853	30007	32315	34623	36931	39239	41548	43856	46164	48472	50780	53089	55397	57705	60013	64630	69246	73863	78479	80787
48”	1809.562	12.5664	31416	32673	35186	37699	40212	42726	45239	47752	50266	52779	55292	57805	60319	62832	65345	70372	75398	80425	85452	87965
50”	1963.500	13.6354	34089	35452	38179	40906	43633	46360	49088	51815	54542	57269	59996	62723	65450	68177	70904	76358	81813	87267	92721	95448
52”	2123.722	14.7481	36870	38345	41295	44244	47194	50143	53093	56043	58992	61942	64891	67841	70791	73740	76690	82589	88488	94388	100287	103236
54”	2290.226	15.9044	39761	41351	44532	47713	50894	54075	57256	60437	63617	66798	69979	73160	76341	79522	82703	89064	95426	101788	108150	111330
56”	2463.014	17.1043	42761	44471	47892	51313	54734	58155	61575	64996	68417	71838	75259	78680	82100	85521	88942	95784	102626	109467	116309	119730
58”	2642.086	18.3478	45870	47704	51374	55043	58713	62383	66052	69722	73391	77061	80730	84400	88070	91739	95409	102748	110087	117426	124765	128435
60”	2827.440	19.6350	49088	51051	54978	58905	62832	66759	70686	74613	78540	82467	86394	90321	94248	98175	102102	109956	117810	125664	133518	137445

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Conversions Factors & Formulas

DECIMAL EQUIVALENTS OF COMMON FRACTIONS AND METRIC CONVERSIONS					
Fractions	Decimals	Millimeters	Fractions	Decimals	Millimeters
1/64	0.016	0.396	33/64	0.516	13.096
1/32	0.031	0.792	17/32	0.531	13.492
3/64	0.047	1.189	35/64	0.547	13.889
1/16	0.063	1.588	9/16	0.563	14.288
5/64	0.078	1.984	37/64	0.578	14.684
3/32	0.094	2.380	19/32	0.594	15.080
7/64	0.109	2.776	39/64	0.609	15.476
1/8	0.125	3.175	5/8	0.625	15.875
9/64	0.141	3.571	41/64	0.641	16.271
5/32	0.156	3.967	21/32	0.656	16.667
11/64	0.172	4.364	43/64	0.672	17.064
3/16	0.188	4.763	11/16	0.688	17.463
13/64	0.203	5.159	45/64	0.703	17.859
7/32	0.219	5.555	23/32	0.719	18.255
15/64	0.234	5.951	47/64	0.734	18.651
1/4	0.250	6.350	3/4	0.750	19.050
17/64	0.266	6.746	49/64	0.766	19.446
9/32	0.281	7.142	25/32	0.781	19.842
19/64	0.297	7.539	51/64	0.797	20.239
5/16	0.313	7.938	13/16	0.813	20.638
21/64	0.328	8.334	53/64	0.828	21.034
11/32	0.344	8.730	27/32	0.844	21.430
23/64	0.359	9.126	55/64	0.859	21.826
3/8	0.375	9.525	7/8	0.875	22.225
25/64	0.391	9.921	57/64	0.891	22.621
13/32	0.406	10.317	29/32	0.906	23.017
27/64	0.422	10.714	59/64	0.922	23.414
7/16	0.438	11.113	15/16	0.938	23.813
29/64	0.453	11.509	61/64	0.953	24.209
15/32	0.469	11.905	31/32	0.969	24.605
31/64	0.484	12.301	63/64	0.984	25.001
1/2	0.500	12.700	1	1.000	25.400

AREAS AND CIRCUMFERENCE OF CIRCLES		
Area in Sq. In.	Circumference	Dia.
3.142	6.283	2”
7.069	9.425	3”
12.566	12.566	4”
19.635	15.708	5”
28.274	18.850	6”
38.485	21.991	7”
50.266	25.133	8”
63.617	28.274	9”
78.540	31.416	10”
95.033	34.558	11”
113.098	37.699	12”
132.733	40.841	13”
153.938	43.982	14”
176.715	47.124	15”
201.062	50.266	16”
226.981	53.407	17”
254.470	56.549	18”
314.160	62.832	20”
380.134	69.115	22”
452.390	75.398	24”
530.930	81.682	26”
615.754	87.965	28”
706.860	94.248	30”
804.250	100.531	32”
907.922	106.814	34”
1017.878	113.098	36”
1134.118	119.381	38”
1256.640	125.664	40”
1385.446	131.947	42”
1520.534	138.230	44”
1661.906	144.514	46”
1809.562	150.797	48”

Common Formulas

Area of Circle = 3.1416 x r^2
Circumference = 3.1416 x D
Cubic ft. x .0283 = Cubic meters
Feet x 30.48 = Centimeters
Feet x 304.8 = Millimeters
Inches x 2.54 = Centimeters
Inches x 25.4 = Millimeters
Kilograms x 2.2046 = Lbs
Kilometers x 0.6214 = Miles
Kilometers x 3280.9 = Feet
Lbs. x .4536 = Kilograms
Meters x 3.281 = Feet
Miles x 1.6093 = Kilometers
Millimeters x .03937 = Inches
MPH x 1.4667 = Feet per second
MPH x 88 = Feet per minute
Temp. °C to °F = °C x 1.8 + 32
Temp. °F to °C = °F - 32 x .556

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